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Publications of the United States National Museum

The scientific publications of the United States National Museum include two series, *Proceedings of the United States National Museum* and *United States National Museum Bulletins*.

In these series are published original articles and monographs dealing with the collections and work of the Museum and setting forth newly acquired facts in the fields of anthropology, biology, geology, history, and technology. Copies of each publication are distributed to libraries and scientific organizations and to specialists and others interested in the various subjects.

The *Proceedings*, begun in 1878, are intended for the publication, in separate form, of shorter papers. These are gathered in volumes, octavo in size, with the publication date of each paper recorded in the table of contents of the volume.

In the *Bulletin* series, the first of which was issued in 1875, appear longer, separate publications consisting of monographs (occasionally in several parts) and volumes in which are collected works on related subjects. *Bulletins* are either octavo or quarto in size, depending on the needs of the presentation. Since 1902, papers relating to the botanical collections of the Museum have been published in the *Bulletin* series under the heading *Contributions from the United States National Herbarium*.

FRANK A. TAYLOR
Director, United States National Museum

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A NEW SPECIES OF BURROWING ACONTIATE ANEMONE FROM CALIFORNIA (ISOPHELLIIDAE: FLOSMARIS)

By CADET HAND *and* RALPH BUSHNELL

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A NEW SPECIES OF BURROWING ACONTIATE ANEMONE FROM CALIFORNIA (ISOPHELLIIDAE: FLOSMARIS)

By CADET HAND *and* RALPH BUSHNELL[1]

In a series of papers, Hand (1955, 1955a, 1956, 1958) described certain of the sea anemones of central California. The new species herein considered adds to that list.

The first specimens were collected in 1949 from intertidal mud flats of San Francisco Bay adjacent to Bay Farm Island, Alameda County, California. The flat is composed of fairly firm sand in which is mixed considerable mud and accumulated mollusk shells in various stages of disintegration.

The anemones occur with the base attached to fair sized remains of clam shell, small stones or even pieces of wood some 30–46 cm. beneath the surface. The oral end extends to the surface. Thus, when located in their original habitat, most of the 70 animals so far found, were about 30–46 cm. in length; however, they are only about 6–7 mm. in diameter except at the disc and base. The base may be up to 2.5 cm. in diameter and well covered with bits of clam shell and much sand, which remain adhering when the animal is dug from its burrow. Much care is needed in digging this species from its natural position as it is very easy to misjudge the depth at which the base is located,

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and, as frequently happens, the specimen may be cut in two before the base is freed from its attachment.

The area inhabited by this species is between the midintertidal and the mean lower-low water level, and they are most easily obtained by searching for them when there is a good minus tide. At these times they are commonly observed with their tentacles extended at the entrance to their burrow, but any movement near them will cause them to contract so that the body is drawn down into the burrow. As one starts to dig for them, they continue to contract until they reach one-third or less of their normal length. When the collector is successful in dislodging them he retrieves an anemone appearing to be about 10–15 cm. long and about 2 cm. in diameter at its widest part (exclusive of the foot). Occasionally, when too much pressure is applied against them in their burrows they will be seen to emit tiny jets of water from cinclis-like openings in the upper column. We do not believe that this is a natural reaction or one that would occur frequently in the absence of abnormal pressure. Weak areas evidently occur in the upper part of the column, but histologically these do not appear to be typical cinclides.

So far in the laboratory, we have not been able to relax specimens to anywhere near their normal length, i.e., 30–46 cm. On preservation they tend to shorten to 15 cm. or less.

We wish to thank both Mr. Marshall and Mr. Holleman for making the observations reported herein available to us.

This work was supported by a grant from the National Science Foundation, GB 1237, and by a contract with the Atomic Energy Commission, AT (11–1)–34, Project #96.

Family Isophelliidae

ISOPHELLIIDAE Stephenson, 1935, p. 183.

Thenaria (Acontiaria). Sphincter mesogloeal. Mesenteries divisible into macro- and microcnemes; the older microcnemes may, however, be provided with filaments and acontia. Acontia with two categories of nematocysts, basitrichs, and microbasic amastigophores.

Genus *Flosmaris*

Flosmaris Stephenson, 1920, p. 441.

Isophelliidae with the elongate column divisible into scapus and scapulus, the former with tenaculi. Cinclides present or possibly absent. Margin tenaculate. Tentacles simple, their longitudinal muscles ectodermal as are the radial muscles of oral disc. Sphincter mesogloeal; situated in upper part of scapulus. Twelve pairs of macrocnemes bearing gonads, though number may vary as result of

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asexual reproduction. Macrocnemes all perfect and with strongly restricted to circumscribed retractors. Microcnemes weak, consisting chiefly of parietal muscle. Acontia present on macrocnemes and sometimes on some microcnemes. Cnidom: spirocysts, basitrichs, microbasic amastigophores; also atrichs and holotrichs if catch-tentacles are present.

The generic diagnosis above is the one given by Hand (1961). It differs slightly from that of Stephenson (1920) and incorporates certain modifications resulting from the inclusion of *Flosmaris bathamae* Hand (1961) in this genus.

Flosmaris grandis, new species

FIGURES 1, 2

Base: Generally circular, adherent and usually larger than scapus. Basilar muscles present and well developed.

Column: Elongate, divided into scapus and scapulus, cylindrical and up to 20 cm. long and 2 cm. diameter in the preserved condition. In living condition within their burrows, column is up to 46 cm. long. Diameter of column tapers from less than 0.5 cm. just above base to about 1.5 cm. in region of scapulus in a large individual. Removed from natural surroundings, column usually expanded in upper two-thirds, tapering to meet flaring base, and resembling long, slender goblet (fig. 1). Column translucent or pale white, depending on degree of expansion or contraction of individual. Mesenterial insertions visible as pale white lines.

Scapulus short, usually less than one-fifth of total column, somewhat more transparent than scapus and thereby distinguished from the latter. Histological preparations show a thinning of all layers in the scapulus. No cinclides or tenaculi present in scapulus and there appear to be fewer gland cells in scapus.

Scattered tenaculi present in upper third of scapus, but sand grains rarely found attached to them. Weakened areas somewhat comparable to poorly developed cinclides present in upper part of scapus. Mesogloea of column about of the same thickness as endoderm but only about 0.8 as thick as ectoderm.

Mesogloeal sphincter (fig. 2*a*) fairly well developed at top of the scapulus and immediately adjacent to tentacle bases.

Circular, endodermal muscles present throughout length of column but not extensively developed.

Tentacles and Oral Disc: All the specimens so far examined have only regular tentacles, catch tentacles being unobserved. From 90 to 144 tentacles have been counted on various individuals. Inner tentacles usually hexamerously arranged. Individual tentacles extend to 1.6 cm. in length, and total crown may attain a diameter of as much as 3.5 cm. Tentacles thin, transparent, and gently tapered.

Only a small amount of coloration is found on animal and is in bars or incomplete rings of white granules against a dark background at bases of tentacles. Lips seldom seen raised above level of disc and are smooth and unpigmented.

Tentacles fully retractile and have ectodermal longitudinal muscles. Radial musculature of disc is ectodermal also.

Mesenteries: In upper part of body of perfect specimens there are 12 pairs of complete and fertile macrocnemes, including 2 pairs of directives that correspond to the 2 siphonoglyphs, and 36 pairs of

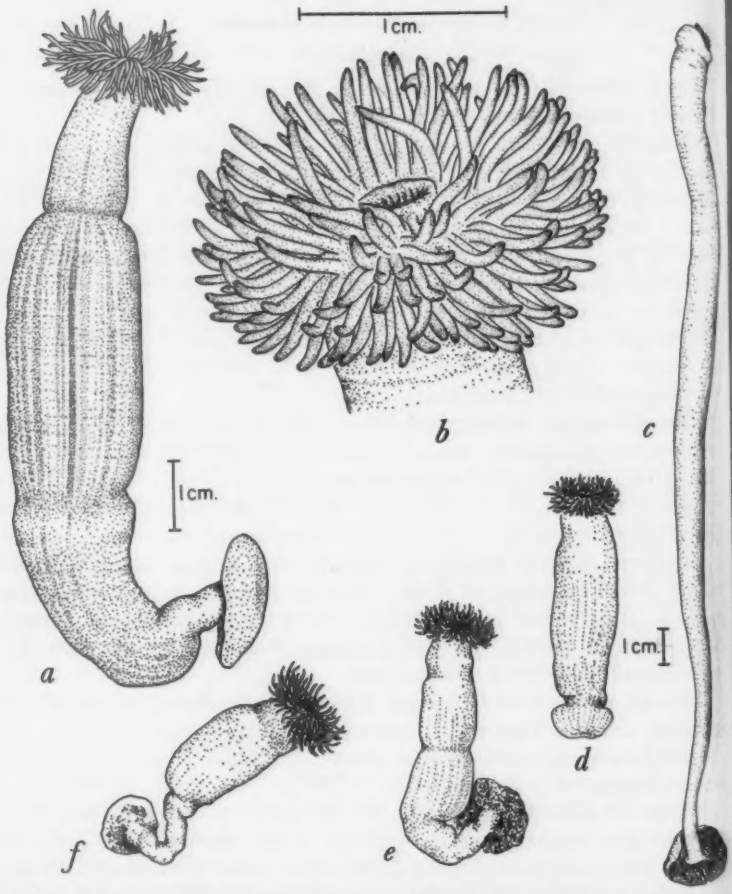

FIGURE 1.—*Flosmaris grandis: a, d–f,* live specimens removed from their burrows; *b,* enlargement of the oral disc and tentacles; *c,* relaxed and extended preserved specimen.

microcnemes (fig. 2*b*). In scapus, especially lower parts, number of microcnemes decreases, and there are approximately half as many mesenteries at base as in oral end (fig. 2*c*). Dissections of 12 specimens and sections of 6 showed from 8 to 12 pairs of mesenteries may be perfect, fertile macrocnemes (fig. 2*d*). No form of asexual reproduction has been observed in this species.

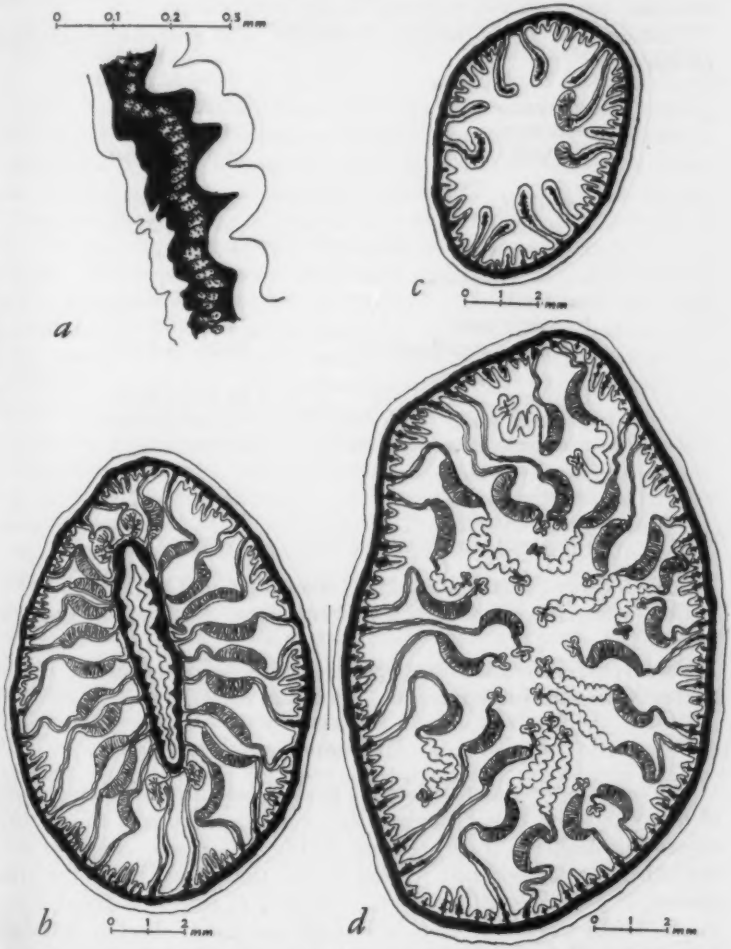

FIGURE 2.—*Flosmaris grandis: a*, sphincter muscles within the mesogloea; *b*, cross section of mesenteries in region of actinopharynx; *c*, cross section of column just above pedal disc; *d*, mesenteries in midregion of the column.

The 6 pairs of macrocnemes of first cycle have large restricted retractors (fig. 2*b*) running throughout their length, while second cycle has only slightly smaller restricted retractors. Directive retractors tend to be circumscript. There is a moderately well-developed parietal musculature on macrocnemes, while microcnemes (fig. 2*b*) consist only of parietal muscles, there being no mesenterial sheet. A trifid mesenterial filament and acontium are present on each macrocneme, but were not observed on any microcneme.

Cnidom (spirocysts, atrichs, basitrichs, and microbasic amastigophores):

	microns
tentacles	
spirocysts	17–22×3.0–4.0
basitrichs	19–27×3.0–4.0
basitrichs	14–16×2.5–3.0
scapus	
basitrichs	18–26×3.0–3.5
basitrichs	9–14×2.0–2.5
atrichs (rare)	8–10×3.0
actinopharynx	
basitrichs	26–34×5.0–6.0
basitrichs (rare)	18–20×4.0–5.0
microbasic amastigophores	16–20×5.0–6.0
filaments	
basitrichs	24–29×3.0–4.0
basitrichs (rare)	12–16×2.0–3.0
microbasic amastigophores	14–18×4.5–6.0
acontia	
basitrichs	20–29×2.5–3.0
basitrichs (rare)	16–18×2.0–2.5
microbasic amastigophores	33–42×5.0–7.0

Type locality: Bay Farm Island, Alameda Co., Calif.

Holotype: Deposited in the United States National Museum as no. 52592.

Paratypes: Five additional specimens are deposited in the United States National Museum as nos. 52593 and 52594.

Discussion

The new species described herein is abundant in the intertidal zone of many parts of San Francisco Bay and also occurs in the estuary separating Alameda from Oakland, Calif. *Flosmaris grandis* is only the third species assigned to this genus, the others being the type species, *F. phellioides* Stephenson, 1920, and *F. bathamae* Hand, 1961. *F. phellioides* was described from a single specimen collected at Hulule Island, N. Male Atoll, Maldive Archipelago, and *F. bathamae* is known only from Otago Harbor in southern New Zealand. *F. bathamae* is a small species, the maximum length being about 2.5 cm.,

while *F. grandis* is some 18 times longer than this. The size of *F. phellioides* is not known. There is some question, certainly, whether *F. bathamae* and *F. grandis* are cogeneric with *F. phellioides*. Stephenson's original description of *F. phellioides* is very brief and no diagnosis of nematocysts was given. The new species agrees with the type species in having more mesenteries distally than proximally, but differs from *F. bathamae* in this respect. Also, no catch tentacles have been observed in *F. grandis* or *F. phellioides*, but they are present in *F. bathamae*. *F. grandis* resembles *F. bathamae* in its restricted retractors whereas *F. phellioides* is reported to have circumscript retractors. For the time being it seems most reasonable to treat all these species as members of the genus *Flosmaris*, and what is most needed is fresh material of *F. phellioides*. When *F. phellioides* is rediscovered it should be possible to make a more detailed comparison of these species and, hopefully, to understand better the nature of this genus.

Some interesting observations on *F. grandis* in captivity have been made by Mr. Edward Arthur Marshall, a student at Oakland City College. We received these observations through Mr. John Holleman, a biology instructor at the College. Mr. Marshall has kept individuals of this species in unaerated aquaria for several months and has observed that when detached from the substrate and placed on sand in water that the animals actively burrow and reattach. Burrowing is apparently accomplished by extensions of the pedal disc and undulations of the body. After attaching at a given point on the bottom of an aquarium with a 6.5 cm. deep layer of sand, movement from place to place occurs, and individuals were recorded as having moved a distance of 13 cm. overnight. The captive animals accepted a wide variety of foods including almost any small, soft-bodied organism. They readily accept small flies, the larvae of several insects, gnats, small spiders, small gastropods, and land slugs, brine shrimps, copepods, and small marine organisms in general, but refuse earwigs and small beetles. When food objects are dropped near an anemone, they extend the upper part of the body from their burrow toward the food. Successful capture of the food usually follows. When an injured, but living, house fly is placed on the surface of the aquarium, the anemone actively extends toward the surface of the aquarium, and captures it with its tentacles. This occurs only when the fly is still active and moving but trapped in the surface film. One might wonder if this last described behavior occurs in nature, and while no absolute answer is possible, it is readily demonstrable that many, many insects are indeed blown into the Bay.

The behavior described may then be one which is adaptively valuable to the species and a perfectly normal bit of behavior as well.

Summary

A new species of *Flosmaris*, *F. grandis* is described. This is the third species known in this genus. The genus is not well understood, and the type species, *F. phellioides* from the Maldive Islands needs to be restudied. Some observations on the living animals are reported, and the capture of food on the surface of an aquarium is described.

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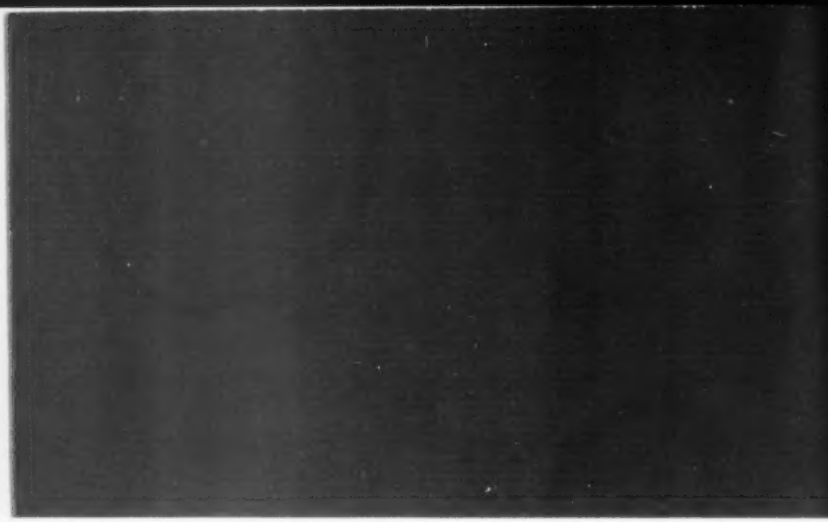

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REVIEW OF SOUTH AMERICAN FRESHWATER ANGELFISHES—GENUS PTEROPHYLLUM

By LEONARD P. SCHULTZ

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Volume 120 1967 Number 3555

REVIEW OF SOUTH AMERICAN FRESHWATER ANGELFISHES—GENUS PTEROPHYLLUM

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The illustration of the new *Plataxoides leopoldi* Gosse (1963, Inst. Roy. Sci. Nat. Belgique Bull., vol. 39, no. 35, pp. 4–6, pl. 1, fig. 2) so closely resembled the illustration of *Plataxoides dumerilii* Castelnau (1855, Animaux nouveaux ou rares . . . d' Amérique du Sud, p. 21, pl. 11, fig. 3) that I decided to review the taxonomic status of all the nominal species of *Pterophyllum*. I shall attempt (1) to clarify the nomenclatural validity of the generic names *Pterophyllum* and *Plataxoides*, (2) to review the species complexes of *Pterophyllum scalare* (=*P. eimekei*) and *Plataxoides dumerilii* (=*P. leopoldi*,), and (3) to discuss the relationship between *Pterophyllum altum* Pellegrin and *P. scalare* (Lichtenstein).

I have studied all nonaquarium specimens of *Pterophyllum* available in the following museums: British Museum of Natural History (BMNH); California Academy of Sciences (CAS); Chicago Natural History Museum (CNHM); Museum of Comparative Zoology, Harvard (MCZ); Museum National Histoire Naturelle, Paris (MNHN); Institut Royal des Sciences Naturelles de Belgique, Bruxelles (IRSNB); Stanford University (SU); U.S. National Museum (USNM). To the authorities of the above institutions, I wish to express my gratitude for their help and other courtesies.

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In the "Tropical Fish Hobbyist" (1953, vol. 1, no. 5, pp. 5–7, 20) I attempted to distinguish three species of aquarium-bred *Pterophyllum*. Since then I have studied specimens collected from their natural habitat, the syntypes of *Pterophyllum altum* Pellegrin, a syntype of *P. eimekei* Ahl, 27 paratypes of *Plataxoides leopoldi* Gosse, and the holotype of *P. dumerilii* Castelnau.

In my 1953 study I recognized *Pterophyllum scalare*, *P. eimekei*, and *P. altum* as valid species; however, with additional material my conclusions have changed and in this review I now recognize as valid *P. scalare*, *P. altum*, and *P. dumerilii*. *P. eimekei* is a synonym of *P. scalare*.

In the synonomy for each species I have recorded only the most pertinent references, omitting those related to aquaria.

I have attempted to record each locality from which *Pterophyllum* has been reported by latitude and longitude as found in "The Times Atlas of the World," 1957, vol. 5 ("The Americas"); "U.S. Board of Geographic Names Gazetteer," no. 56 ("Venezuela") and no. 71 ("Brazil"); Eigenmann's "The American Characidae," 1917, pt. 1, pl. 1; and Eigenmann and Allen's "Fishes of Western South America," 1942, pp. 67–81. Since I was unable to find a few localities, specimens from such places are not included in the distributional map for the species (pl. 1). Some of the other records are so unspecific in locality, e.g., "Rio Orinoco," that these cannot be plotted on the map. I have studied the routes followed by the collectors; the latitude and longitude used represents the best estimate for the information available.

The specific localities from which specimens of *Pterophyllum* have been collected are as follows:

locality	*longitude*	*latitude*
Ambyiacu, Río, Peru	3°10′ S	73°13′ W
Araguaia, Rio, near Aruana, Brazil	14°54′ S	51°05′ W
Atabapo, Río, Colombia	4°03′ N	67°45′ W
Belém [=Pará], Brazil	1°30′ S	48°55′ W
Cacaul or Cacauoal [=Cacoal], Brazil	1°59′ S	46°13′ W
Cashiboya, Lago above Contamana, Peru	7°19′ S	75°04′ W
Casiquiare, Río, Venezuela	2°01′ N	67°07′ W
Coary, Brazil	4°08′ S	63°07′ W
Crab Falls, British Guiana	5°17′ N	58°59′ W
Cupai [probably Rio Cupari], Brazil	3°04′ S	55°25′ W
Demerara or Georgetown, British Guiana	6°46′ N	58°10′ W
Iquitos, Peru	3°51′ S	73°13′ W
Jutahy, Brazil	3° S	66°57′ W
Manacapurú, Brazil	3°18′ S	60°37′ W
Manacapurú, Lago, Brazil	3°10′ S	61°30′ W
Manaus, Brazil	3°06′ S	60°00′ W
Marajó I, in Amazon, Brazil	1°45′ S	49° W
Maximo, Lago, Brazil	(?)	(?)
Monte Alegre, Brazil	2°01′ S	54°04′ W

locality	longitude		latitude	
Nazareth, Brazil	1°13′	N	67°51′	W [probably]
Óbidos, Brazil	1°52′	S	55°30′	W
Pacaya, Río [see Yarinacocha]				
Pévas [=Pébas] Caño, Peru	3°10′	S	71°46′	W
Pôrto Alegre, Brazil	4°23′	S	52°45′	W
Pôrto do Móz, Brazil	1°45′	S	52°10′	W
Pôrto Negro [probably near Manaus], Brazil				
Purus, Río, Brazil	3°42′	S	61°28′	W
Rockstone, British Guiana	6°00′	N	58°30′	W
Rupununi River, British Guiana	3°55′	N	59°06′	W
Santarém, Brazil	2°26′	S	54°41′	W
Solimões, Rio, at Manacapurú, Brazil	3°18′	S	60°37′	W
Tabatinga, near Leticia, Brazil	4°14′	S	69°44′	W
Tefé [=Teffé], Rio, Brazil	3°24′	S	64°45′	W
Tonantins, Brazil	2°46′	S	67°45′	W
Ueranduba, Brazil	(?)		(?)	
Urubu Rio, Brazil	2°55′	S	58°25′	W
Villa Bella [Rio Ramos], Brazil	2°36′	S	56°39′	W
Xingu, Rio [Pôrto Alegre], Brazil	4°23′	S	52°45′	W
Yarinacocha [Río Pacaya], Peru	5°10′	S	74°	W

Pterophyllum Heckel

Pterophyllum Heckel, 1840, Ann. Wien. Mus., vol. 2, no. 12, p. 334 [type species: *P. scalare* Heckel=*Plataz scalaris* Cuvier and Valenciennes].—Ahl, 1928, Zool. Anz., vol. 76, p. 252 [revision of 3 species].

Plataxoides Castelnau, 1855, Animaux nouveaux ou rares . . . de l'Amerique du Sud . . . , p. 21, pl. 11, fig. 3 [type species: *P. dumerilii* Castelnau].

TABLE 1.—*Number of vertebrae in* Pterophyllum

Species and localities	Abdominal			Caudal					Total				
	12	13	14	14	15	16	17	18	27	28	29	30	31
dumerilii													
British Guiana		1			1					1			
Rio Negro-Amazon		2	1	1	2					2			
Rio Negro, types of *leopoldi*	5	21		7	16	3			10	15	1		
Belém and Marajó Island	1						1				1		
altum													
Upper Orinoco		2					2					2	
scalare													
British Guiana		26		1	8	13	4		1	8	13	4	
Middle and lower Amazon		13				6	6	1			6	6	1
Belém and Marajó Island		7					7					7	
Peruvian Amazon		7			2	4	1			2	4	1	

The validity of the generic name *Pterophyllum* Heckel, long in use by ichthyologists and aquarists, needs to be clarified because Gosse (1963, p. 4) used the generic name *Plataxoides* Castelnau instead of *Pterophyllum*. Gosse (loc. cit.) and Whitley (1951, Proc. Roy. Zool.

Soc. New South Wales, p. 68) were in error in considering that *Pterophyllum* Heckel is not available as a generic name with the type species *Pterophyllum scalare* Heckel (=*Zeus scalaris* Lichtenstein). Myers (1940, Stanford Ichthy. Bull., vol. 2, no. 1, p. 36) pointed out that Neave (1940, Nomenclator zoologicus, vol. 3, p. 1028) was in error in the following statement: "*Pteropyhllum* (pro-lla, Kirby 1825), Harris 1833, in Hitchcock, Rept. Geol. Min. Bot. Zool. Massach., 582-Orth." I have checked Harris (1833, 1835, Rep. Geol. Mineral. Bot. Zool. Massachusetts) and can verify Myers' observation that Harris consistently used *Pterophylla*, leaving *Pterophyllum* available.

Pterophyllum dumerilii (Castelnau)

PLATE 2

Plataxoides dumerilii Castelnau, 1855, Animaux nouveaux ou rares . . . de l'Amérique du Sud . . . , p. 21, pl. 11, fig. 3 [Pará=Belém].

Plataxoides leopoldi Gosse, 1963, Inst. Roy. Sci. Nat. Belgique Bull., vol. 39, no. 35, p. 4, pl. 1, fig. 2 [mouth of Rio Solimões, about 90 km above Manacapurú].

Specimens studied (see page 2 for more precise locality): BMNH 1902–11–4–10–12, Marajó, 3 (27 to 40 mm); BMNH 1902–2–11–4–9, Tonantins, 1 (41 mm); MCZ (out of 14992), Tefé, 2 (33 and 37mm); CNHM (out of 15254); Santarém, 1 (40 mm): CNHM 53846 Rupununi River, 2 (33 and 54 mm); CNHM (out of 54370), Santarém, 1 (37 mm.); USNM 167772, Rupununi River, 1 (40 mm.); USNM 198177, Rio Urubu, 1 (45 mm.); USNM 198178, Rio Purús, 2 (29 and 31 mm.); IRSNB 460, Rio Solimões. 90 km above Manacapurú, 27 paratypes of *P. leopoldi*, (34 to 61 mm); MNHN A 254, Pará, Brazil, holotype of *P. dumerilii* (49 mm); MNHN 221–61–3–7, Cacaual, 1 (37 mm); MNHN 221–61–3–6, Caldron, 2 (42 and 51 mm).

I examined the holotype of *Plataxoides dumerilii* Castelnau at the Museum National Histoire Naturelle, Paris, and found that Castelnau's illustration (1855, pl. 11) is in error. In his illustration, a black spot is shown behind the prominent black vertical bar that extends from the middle of the dorsal fin across body to the middle of the anal fin, whereas in the holotype this spot now shows as a trace in front of that dark bar, not behind it. Also, the dark vertical bars anteriorly on the illustration are incorrectly portrayed. On the holotype a short bar extends from the spiny dorsal origin ventrally to the lateral line, another short bar occurs halfway between the eye and the spiny dorsal origin; there is also a dorsoventral bar through the eye and across the cheek. These bars are prominent in well-preserved specimens and their positions differ notably from those of *Pterophyllum scalare* and *P. altum*. On the latter two species, the black bar through the eye extends dorso-posteriorly to the origin

of the spiny dorsal fin, replacing the two middle predorsal vertical bars on *P. dumerilii*. Thus, on the basis of coloration *P. dumerilii* can always be distinguished from *P. scalare* and *P. altum*. The number of vertebrae averages slightly fewer in *P. dumerilii* than in the other two species (table 1) and there are also slightly fewer soft dorsal and soft anal rays and fewer oblique scale rows (from rear of head to midbase of caudal fin) (table 2) than in *P. scalare* and

TABLE 2.—*Counts recorded for* Pterophyllum dumerilii

Localities	Dorsal fin rays										Pectoral fin rays	
	XI	XII	XIII	18	19	20	21	22	23	24	10	11
British Guiana		3		1	1	1						2
Río Negro-Amazon	1	8	1		3	1	2	1	1	2	2	10
Río Negro (types of *leopoldi*)	4	20	2		7	14	5				2	24
Mouth of Amazon		3	1						4		1	3
Holotype of *dumerilii*		1							1			1

Localities	Anal fin rays										Oblique scale rows							
	VI	19	20	21	22	23	24	25	26	27	28	26	27	28	29	30	31	32	33
British Guiana	3		2	1											1	1			
Río Negro-Amazon	10		2	2	2		1	3				1	2	2		3	1		1
Río Negro (types of *leopoldi*)	26	1	8	11	5	1						1	3	9	8	4	1		
Mouth of Amazon	4						1		2		1					1	3		
Holotype of *dumerilii*	1						1									1			

P. altum (table 3); however, these differences are not great enough to enable me to identify all specimens on the basis of fin ray and scale counts, even if the dorsal and anal rays are added to the oblique scale rows to form a character index (table 4).

An examination of table 2, shows that the specimens of *P. dumerilii* collected near Belém, at the mouth of the Amazon have a slightly greater number of fin rays and scales than do specimens further up the Amazon—Río Negro systems.

The counts made on the holotype of *P. dumerilii* from Pará (now Belém) with XII,23 dorsal, VI,24 anal, 11 pectoral fin rays, and 30 scale rows along the side, fit into the higher end of the frequency distributions (table 2) for *P. dumerilii*; however, since the frequency distributions partly overlap for the various localities and the number of specimens are not sufficient to establish the extent of variability among populations, if such exist, I am recognizing only a single species, *P. dumerilii*.

P. dumerilii has been collected in the Amazon basin and in the Rupununi River of British Guiana (see open circles in map, pl. 1).

Pterophyllum altum Pellegrin

PLATE 3

Pterophyllum altum Pellegrin, 1903a, Bull. Mus. Hist. Nat. Paris, vol. 9, p. 125 [Rio Atabapo, Orinoco]; 1903b, Mem. Soc. Zool. France, vol. 16, p. 252, pl. 4, fig. 4 [Atabapo].—Regan, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 16, p. 442 [Rio Orinoco].—Eigenmann, 1910, Rep. Princeton Univ. Exped. Patagonia 1896–1899, vol. 3 (Zool.), pt. 4, p. 479 [Orinoco].—Ahl, 1928, Zool. Anz., vol. 76, p. 255 [Orinoco].—Schultz, 1949, Proc. U.S. Nat. Mus., vol. 99, p. 167 [Rio Atabapo]; 1953, Tropical Fish Hobbyist, vol. 1, no. 5, pp. 5–7, 20 [key to aquarium-bred angelfish].

Specimens studied (see page 2 for more precise locality): BMNH 1904–6–28–2–3, Rio Orinoco, 2 (59 and 60 mm); MNHN 221–61–1–3, Chaffanjon (Rio Atabapo), 5 syntypes of *P. altum* (42 to 62 mm); MNHN 221–61–1–1, Chaffanjon, 4 syntypes of *P. altum* (63 to 75 mm); MNHN 221–61–1–2, Chaffanjon, 5 syntypes of *P. altum* (59 to 65 mm); USNM 163204, Venezuela, 1 (79 mm); USNM 196007, Colombia, 1 (67 mm); CAS [no number], Rio Casiquiare, 1 (53 mm).

Pterophyllum altum Pellegrin has a color pattern identical with that of *P. scalare;* however, no black spot occurs on the upper midside as in *P. dumerilii.* The black bar through the eye curves dorsoposteriorly to the origin of the spiny dorsal and is not broken into three separate bars as in *P. dumerilii.*

This species is best recognized from *P. scalare* by the greater average number of median fin rays, oblique scale rows, and vertebrae (tables 1–4). Undoubtedly *P. altum* represents the *P. scalare* type of angelfish in the upper Orinoco, and in having a higher average number of dorsal, anal, oblique scale rows and vertebrae than *P. scalare,* it might be considered to represent only a subspecies of *P. scalare;* however, since *P. altum* has been taken so far only in the upper Orinoco basin, I prefer tentatively to recognize it as a distinct species.

Pterophyllum scalare (Lichtenstein)

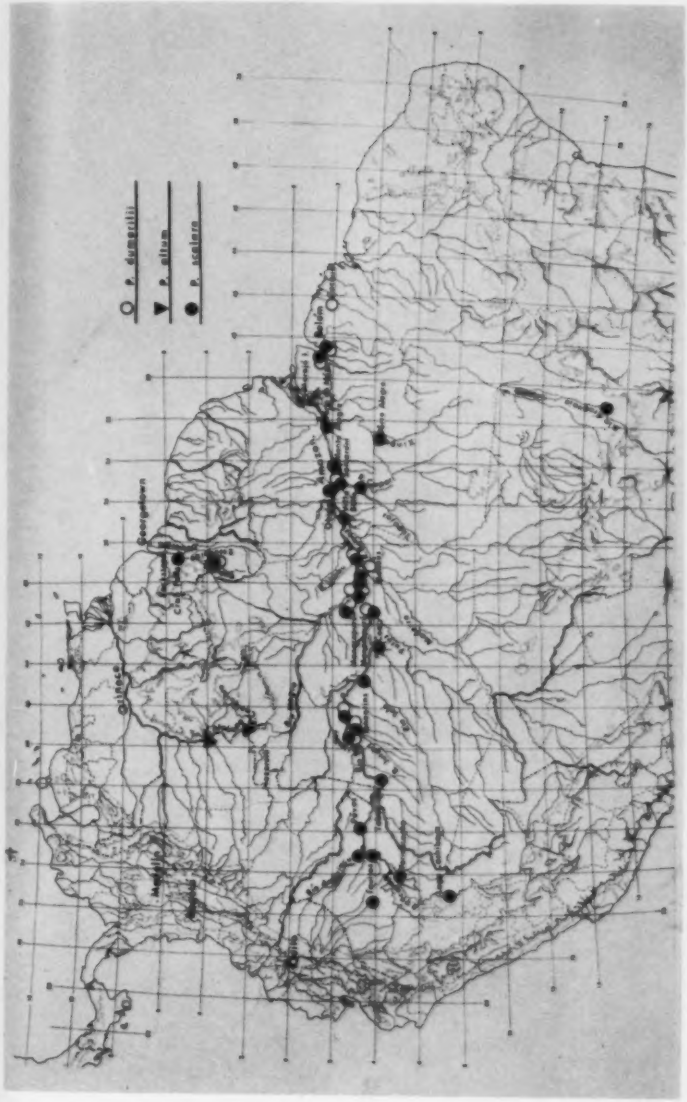
PLATE 4

Zeus scalaris Lichtenstein, 1823, Verz. Doubl. Zool. Univ. Berlin, p. 114 [Brazil].

Platax scalaris Cuvier and Valenciennes, 1831, Histoire naturelle des poissons, vol. 7, p. 237 [Brazil, in "Collection de Bloch, au Musée de Berlin"].

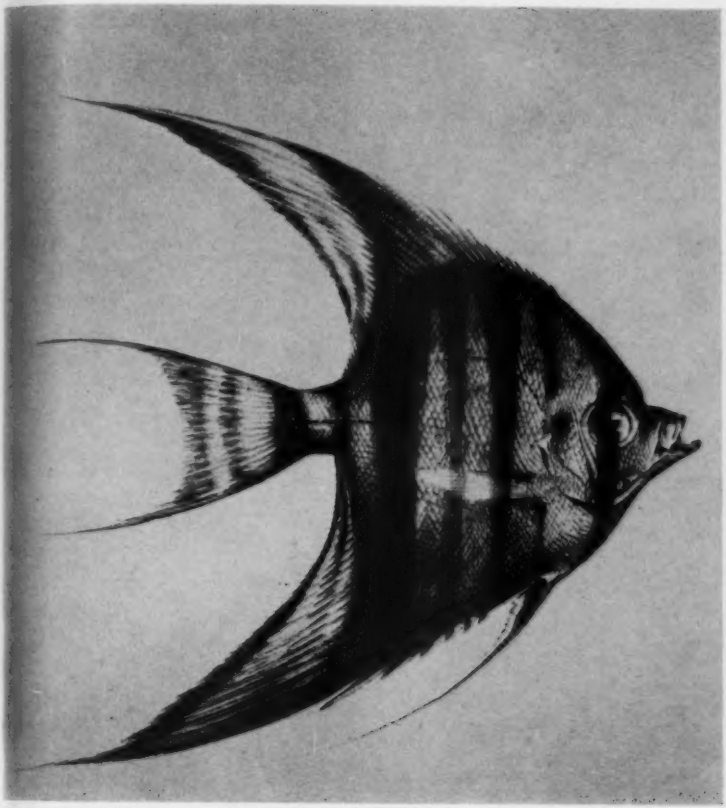
Pterophyllum scalaris Heckel, 1840, Ann. Wien. Mus., vol. 2, p. 335, pl. 30, figs. 5, 6, 7–7a, 8–8b [Reo Negro].

Pterophyllum scalare Günther, 1862, Catalogue of the fishes in the British Museum, vol. 4, p. 316 [Rio Cupai; Brazil].—Kner, 1862, Sitz. Akad. Wiss. Wien., vol. 46, p. 295, pl. 1, figs. 1–1a.—Cope, 1872, Proc. Acad. Nat. Sci. Philadelphia, p. 250 [Rio Ambyiacu].—Steindachner, 1875, Sitz. Akad. Wiss. Wien., vol. 71, p. 76 [Amazon at Santarém, Monte Alegre, Villa Bella, Óbidos, Coary, Ueranduba, Tonantins, Tabatinga, Rio Jutahy, Xingu, Lago Manacapurú, Lago Maximo, Pará, Rio Ambyiacu; ?Barra do Rio Negro].—Eigenmann and Eigenmann, 1891, Proc. U.S. Nat. Mus., vol. 14, p. 71



Distributional map for species of *Pterophyllum*.

Pterophyllum dumerilii (Castelnau).



Pterophyllum altum Pellegrin.

Pterophyllum scalare (Lichtenstein) (courtesy of T.F.H. Publications, Inc.).

[Amazon].—Eigenmann and Bray, 1894, Ann. New York Acad. Sci., vol. 7 p. 624.—Pellegrin, 1903, Mem. Soc. Zool. France, vol. 16, p. 251 [high Peru; upper Amazon, Tefé; Pará].—Regan, 1905a, Ann. Mag. Nat. Hist., ser. 7, vol. 16, p. 441 [Rio Cupai; Tabatinga; Manaus; Tonantins; Marajo Island in Rio Amazon]; 1905b, Proc. Zool. Soc. London, pt. 1, p. 190 [Rio Negro, Brazil].—Ihering, 1907, Rev. Mus. Paulista, vol. 7, p. 335 [Amazon at Tabatinga and tributaries].—Eigenmann, 1910, Rep. Princeton Univ. Exped. Patagonia, 1896–1899, vol. 3 (Zool.), pt. 4, p. 479 [Amazon].—Haseman, 1911, Ann. Carnegie Mus., vol. 7, p. 372 [Santarém, Manaus].—Eigenmann, 1912, Mem. Carnegie Mus., vol. 5, p. 521 [Rupununi River; Rockstone; Crab Falls].—Ribeiro, 1915, Arch. Mus. Nac. Rio de Janeiro, vol. 17, p. 56 [Amazon and tributaries].—Ahl, 1928, Zool. Anz., vol. 76, p. 254 [Amazon].—Eigenmann and Allen, 1942, Fishes of western South America, p. 406 [Iquitos, Yarinacocha].—Fowler, 1945, Los peces del Peru, Mus. Hist. Nat. Javier Prado, Univ. Nac. Mayor de San Marcos, p. 253, fig. 88 [Amazon, Peru].—Schultz, 1949, Proc. U.S. Nat. Mus., vol. 99, p. 167 [Venezuela]; 1953, Tropical Fish Hobbyist, vol. 1, pp. 5–7, 20 [key to aquarium-bred angelfish].

Pterophyllum eimekei Ahl, 1928, Zool. Anz., vol. 76, p. 252, fig. 1 [Rio Negro in the Amazon].

Specimens studied (see page 2 for more precise locality).—The following have USNM catalog numbers: 163210, probably British Guiana, 20 (28 to 63 mm); 198180, Belém, 5 (72 to 78 mm); 198179, Rio Purús, 4 (46 to 67 mm); 179565 and 179566, Rio Urubu, 54 (33 to 80 mm); 163210, probably lower Amazon, 6 (72 to 81 mm); 191591, upper Rio Araguaia, 1 (17.5 mm); 167754, Yarinacocha, 1 (54 mm); 167755, Iquitos, 2 (41 and 63 mm); 26664, Tabatinga, 1 (42 mm); 174942, British Guiana, 3 (71 to 81 mm); 175933, Pévas, 3 (27 to 31 mm). The following have BMNH numbers: 1926–3–3–3, Rio Negro, 1 (60 mm); 1925–10–28–452–457, Manacapurú, 6 (44 to 99 mm); 1926–10–27–488, Monte Alegre, 1 (50 mm); 53–3–19–42, Rio Cupai [probably Rio Cupari], 1 [not measured]; 81–5–13–129, Lago Cashiboya, 1 (43 mm); 85–1–14–71, Tabatinga, 1 (55 mm). The following have MNHN numbers: 221–61–2–1, Rio Negro, 1 syntype of *P. eimekei* (55 mm): 221–61–3–10, French Guiana, 3 (63 to 71 mm); 221–61–3–2, Tefé, 2 (90 and 101 mm); 221–61–3–3, Peru (Amazon), 5 (41 to 51 mm); 221–61–3–4, Peru (Amazon), 3 (50 to 82 mm); 221–61–3–5, Tefé, 5 (30 to 44 mm); 221–61–3–6, Caldron, 2 (65 and 79 mm); 221–61–3–9, Brazil, 3 (49 to 52 mm). The following have CAS numbers: [no number], Rio Negro, 4 (72 to 84 mm); [no number], Santarém, 11 (34 to 50 mm); IU 17780, Yarinacocha, 1 (47 mm); IU 2096, Tabatinga, 1 (43 mm); IU 5106, Lower Amazon, 1 (51 mm); IU 12502, Rupununi River, 1 (34 mm); IU 12504, Essequibo River, 2 (48 and 50 mm); IU 13368, Manaus, 1 (84 mm); [no number] "Pôrto Negro," 4 (46 to 61 mm); 5100, Marajó, 1 (57 mm); IU 12503, Essequibo River, 2 (43 and 44 mm); IU 15988, Iquitos, 4 (42 to 69 mm). The following have MCZ numbers: 14989, Coary, 4 (84 to

Pterophyllum scalare (Lichenstein) (courtesy of T.F.H. Publications, Inc.).

94 mm); 14993, Manacapurú, 2 (59 and 60 mm); 14984, Pôrto do Moz, 2 (47 and 51 mm); 14988, Tonantins, 3 (59 to 94 mm); 14997, Tabatinga, 2 (92 and 99 mm); 14985, Pôrto do Moz, 20 (37 to 48 mm); 14994, Santarém, 10 (46 to 54 mm); 14998, Óbidos, 4 (47 to 71 mm); 14991, Jutahy, 5 (43 to 73 mm); 14992, Jutahy, 3 (39 to 41 mm); 14987, Pôrto do Moz, 5 (40 to 44 mm); 14977 to 14980, Tefé, 10 (51 to 101 mm); 14977 to 14980, 14982 and 14983, Tefé, 6 (74 to 100 mm); 14996, Santarém, 3 (35 to 46 mm); 14990, Villa Bella, 6 (36 to 41 mm); 14999, Pará, 1 (54 mm); 14995, Santarém, 1 (44 mm); 14976, Monte Alegre, 6 (33 to 39 mm); 14981, Tefé, 10 (63 to 98 mm). The following have CNHM numbers: 15254, Santarém, 1 (38 mm); 54371, Manaus, 4 (81 to 90 mm); 54233, Manaus, 1 (49 mm); 53847, Essequibo River, 2 (41 and 43 mm); 54370, Santarém, 3 (40 to 56 mm); 53848, Essequibo River, 4 (44 to 47 mm); 15562, Peru, 1 (53 mm). The following have SU numbers: 36799, Pévas, 1 (62 mm); 36660, near Pévas, 1 (28 mm); 2205, Lower Amazon, 1 (59 mm); 36661, near Pévas, 2 (23 and 26 mm); 36797, near Pévas, 1 (37 mm); 54245, Santarém, 3 (45 to 57 mm); 60504, Pévas, 1 (75 mm); 36798, near Pévas, 3 (22 to 36 mm); 36659, near Pévas, 2 (37 and 46 mm); 36796, near Pevas, 3 (47 to 74 mm).

P. scalare (Lichtenstein) is the common angelfish of aquarists. Since 1928, when Ahl described *P. eimekei* from the mouth of the Rio Negro in the Amazon basin considerable confusion has occurred as to the validity of that species. *P. eimekei* was thought to average fewer dorsal and anal rays and fewer oblique rows of scales (Schultz, 1953) and as indicated by Ahl (1928) and Ladiges (1949, Deutsche Aquar. Terr., year 2, no. 3, pp. 50–52); however, most of their counts were based on aquarium specimens, undoubtedly inbred strains in aquaria, which most probably did not represent the species complex of natural populations found in the Amazon basin. The counts recorded in tables 3 and 4 are based on specimens from definite natural localities and not on aquarium-reared material.

The counts for the syntype of *P. eimekei* with XIII, 24 dorsal, VI, 26 anal, 10 pectoral fin rays, and 36 scale rows on the side fall nearly in the middle of the frequency distributions for Amazon specimens of *P. scalare* (tables 3 and 4). Thus, I conclude that *P. eimekei* is a synonym of *P. scalare*.

The differences between the color patterns of *P. scalare* and *P. dumerilii*, discussed under the latter species and shown in plates 1 and 3, should make identification easy; however, *P. scalare* and *P. altum* cannot be distinguished on the basis of coloration. The chief differences are the greater number of soft dorsal and soft anal fin rays and the number of scales in *P. altum* (tables 3 and 4). *P. altum* has 27 to 31 soft dorsal rays whereas *P. scalare* rarely has more than 26.

TABLE 3.—*Counts recorded for* Pterophyllum scalare *and* P. altum

TABLE 3.—*Counts recorded for* Pterophyllum scalare *and* P. altum

Species and localities	Dorsal fin rays XI	XII	XIII	XIV	21	22	23	24	25	26	27	28	29	30	31	Anal fin rays V	VI	VII	22	23	24	25	26	27	28	29	30	31	32
altum																													
Upper Rio Orinoco	3	15	1								1	10	5	2	1		19								1	7	6	3	1
scalare																													
British Guiana	1	20	10	2	2	7	7	10	7							2	30	1	1	5	9	4	8	4	2				
Upper R. Araguaia		1					1										1			1									
Belém; Marajó I.	1	8	1				3	2	1	2	1	1					10				1		2	1	3	2	1		
Pôrto do Móz		17	10			4	13	8	2							2	25			1	6	10	7	1	2				
Santarém, Óbidos; Villa Bella; R. Cupari; Pôrto Negro; Monte Alegre		27	21	1	1	11	24	10	2		1						48			5	13	18	9	2	1				
Manaus; R. Urubu; R. Purus; Manacapurú; Coary		26	42				11	29	24	14	1					2	72	3			2	9	16	32	13	5	1		
Teffé		6	26	1			2	14	12	5							32				1	7	11	11	2				
Tonantins; R. Jutahy; R. Solimões; Tabatinga		9	7			1	5	5	5								16				4	4	5	2	1				
Peruvian Amazon		30	5			2	13	18	2								33	2		1	12	14	6	2					

Species and localities	Pectoral rays 10	11	12	Oblique scale rows 28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
altum																							
Upper Rio Orinoco	1	20														5	4	2	1	1	3	1	2
scalare																							
British Guiana	8	20		1	3	3	3	4	2	3	4	2	1	2	2	2							
Upper R. Araguaia, Belém, Marajó I.	1	7	6				3		2		1				1		1	2		1			
Pôrto do Móz		27			1	1	3	4	7	4	4	2	1										
Santarém Óbidos, Villa Bella; R. Cupari; Pôrto Negro; Monte Alegre	1	30	2		1	5	4	9	11	10	7	1	1	2									
Manaus; R. Urubu; R. Purus; Manacapurú; Coary	3	56	6				3	4	6	10	18	14	13	7	1		1	1					
Teffé	1	32					1	1	4	4	6	6	4	3	2	1							
Tonantins; R. Jutahy; R. Solimões; Tabatinga	1	14				1	2	5	2	1		3		2									
Peruvian Amazon	8	22				2	8	4	7	6	3	4	1										

Although proportional measurements were made on all three species of *Pterophyllum*, the great variability even at nearly equal sizes suggests that little reliance can be placed on measurements for identification purposes.

TABLE 4.—*Character index: Total number of rays in dorsal and anal fins added to number of scale rows for* Pterophyllum

Species and localities	83 85 87 89 91 93 95 97 99 101 103 105 107 109 111 113 115 117 119 121 123 125 84 86 88 90 92 94 96 98 100 102 104 106 108 110 112 114 116 118 120 122 124 126
altum	
Upper Rio Orinoco	3 5 4 4
scalare	
British Guiana	1 1 3 4 5 3 3 1 6 3 2
Upper R. Araguaia	1
Belém; Marajó I.	1 3 1 2 1 1 1
Pôrto do Móz	1 5 2 5 2 1 1
Santarém; Óbidos, Villa Bella; R. Cupari; Pôrto Negro; Monte Alegre	3 4 8 8 11 3 1 1
Manaus; R. Urubu; R. Purus; Manacapurú; Coary	3 5 17 8 19 7 1 1
Tefé	1 1 1 6 7 5 1
Tonantins; R. Jutahy; R. Solimões; Tabatinga	1 3 2 6 1 1 1 1
Peruvian Amazon	3 9 9 10 3 1
dumerilii	
British Guiana	1 2
Rio Negro-Amazon	2 3 2 1 1
Rio Negro (type of *leopoldi*)	1 8 9 7 1
Mouth of Amazon, Cacaual	1 1 2

An inspection of tables 3 and 4 indicates that for *P. scalare* there may be certain areas where distinct populations exist; the specimens from Pôrto do Moz, Santarém, Óbidos, for example, average fewer soft dorsal fin rays than specimens from Manaus, Rio Urubu, and Tefé. Specimens from British Guiana have about the same counts as those listed from Pôrto do Moz. Before any conclusion can be made for the "population" at the mouth of the Amazon, large series will need to be studied to find out the meaning of the bimodal nature of the frequency distribution for specimens from Belém and Marajó Island.

P. scalare ranges in the Amazon Basin and in the Rupununi and Essequibo Rivers of British Guiana with a single record from French Guiana (MNHN 221–61–3–10), the exact locality unknown. The known localities represented by specimens studied by me are recorded in plate 1.

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By WILLIAM STEPHENSON AND MAY REES

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By WILLIAM STEPHENSON and MAY REES [1]

Introduction

The material on which the following report is based was received for identification as part of a program of systematic research on the marine fauna of the tropical Pacific area, with studies of related faunas as required, sponsored jointly by the Biology Branch of the Office of Naval Research [Contract NONR 1354(09)] and the Division of Biology and Medicine of the Atomic Energy Commission [Contract AT (30–1)2409]. No attempt has been made in this study to incorporate material previously identified and cataloged in the collections of the Smithsonian Institution.

The collections as received included 96 species, but only 82 are reported below. The remaining are western American species, which have been included in a monograph by Dr. John S. Garth and the senior author (Garth and Stephenson, 1966), and species of *Ovalipes*, which are to be included in a revision of the genus.

Initially, 12 of the 82 species were new, but Crosnier (1962) described 5 of them. No doubt a considerable number of Indo-West-Pacific species still await description, and the time for a comprehensive monograph is still distant.

[1] Both authors: Department of Zoology, University of Queensland, St. Lucia, Brisbane, Australia. Manuscript submitted for publication in February 1965.

As the group becomes better known, identifications become easier only in certain directions. In the present work some clarification is effected by recognizing the validity of species previously synonymized. As more species are discovered, however, the distinctions between them become narrower, and the difficulties of relating them to the older descriptions increase. Until type material is reexamined and redescribed, several groups must remain confused. In the present work these are termed "complexes," and the *Portunus gladiator* and *P. longispinosus* complexes have caused particular difficulty.

A more fundamental problem concerns the importance attached to differences in male secondary sexual characteristics. Shapes of male abdomens have long been recognized as having diagnostic importance, and since Stephenson (1945), following Brocchi (1875), increasing stress has been laid upon male first pleopods.

In both these structures the extent of "expectable" variation has been known in general terms, and few cases of greater variation have been described (e.g., male pleopods of *P. orbitosinus* by Gordon, 1938, and male abdomens of *P. granulatus* by Crosnier, 1962). In the present work unexpected variability in male pleopod structure has been noted in several cases. In one species (*P. orbitosinus*) there is approximately continuous gradation between wide extremes, and in three others (*Thalamita stimpsoni*, *T. danae*, and *Portunus argentatus*) there is distinct male dimorphism. If a species is defined in terms of a distinct morphological gap between two forms, *T. stimpsoni*, *T. danae*, and *P. argentatus* should each be split into two species. However, apart from male pleopods and abdomens, no structural differences could be found. For the purposes of the present paper, *P. argentatus* was taken as a "test case" of the concept of a portunid species (see p. 19). This concept implies a distinct morphological gap in general facies, as well as in the shape of the male abdomens and structure of the male pleopods. If no distinctions were noted in general facies, groups with different pleopods are here recorded as different "forms." Possibly they are incipient species.

Details of synonymy vary from species to species; where there had been past confusion, reasonable detail is given, but in other cases only critical references are cited. Brief morphological comments are given upon species adequately treated in recent literature, and fuller redescriptions are restricted to inadequately described species. Subfamily headings follow Stephenson and Campbell (1960); within subfamilies genera are in alphabetical order, and within genera species are also in alphabetical order, except where similar species are grouped into "complexes."

Geographical distributions adhere closely to the expected pattern, with the better known species extending from East Africa and the Red Sea to India, Japan, Australia, and the mid-Pacific islands. Only one of the present species (*Thalamita picta*) and one species of *Ovalipes* (see later work) are known to cross the mid-Pacific boundary.

Listed specimens within the 16 main locality groupings are recorded in chronological order. The locality groupings are: East Africa, including Saudi Arabia and the Red Sea; Malay Peninsula, including Rangoon and Sumatra; China, including Hong Kong and Formosa; Philippines, including the Sulu Sea and North Borneo; Celebes; Australia; Melanesia, including New Guinea, Fiji, and the Solomon Islands; Palau Islands, including the Carolines; the Marianas, including Yap and Guam; Japan; the Marshalls; the Gilbert Islands; Samoa; Fanning Island; Hawaii; and the Tuamotu and Society Islands.

Throughout, two abbreviations are used: "*Alb.*" for collections of the U.S. Fish Commission Steamer *Albatross* either from the Philippines, Japan, or Samoa, and "GVF" for "George Vanderbilt Foundation." And, throughout, dimensions are those of total breadths, including the last anterolateral teeth. In cases of damage, the approximate estimated breadth of the undamaged specimen is given. Specimens considered too small or too damaged for identification have been excluded from this account.

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Checklist

Subfamily Catoptrininae Borradaile

Genus *Carupa* Dana
tenuipes Dana

Genus *Libystes* A. Milne Edwards
truncatifrons (de Man)

Subfamily Macropipinae Stephenson and Campbell

Genus *Parathranites* Miers
orientalis Miers

Subfamily Caphyrinae Alcock

Genus *Caphyra* Guérin
rotundifrons (A. Milne Edwards)

Genus *Lissocarcinus* Adams and White
orbicularis Dana

Subfamily Portuninae Stephenson and Campbell

Genus *Charybdis* de Haan
(*Charybdis*) *anisodon* de Haan
(*Charybdis*) *callianassa* (Herbst)
(*Charybdis*) *curtilobus*, new species
(*Charybdis*) *feriatus* (L.)
(*Charybdis*) cf. *feriatus* (L.)
(*Charybdis*) *hellerii* (A. Milne Edwards)
(*Charybdis*) *japonica* (A. Milne Edwards)
(*Charybdis*) *miles* (de Haan)
(*Charybdis*) *natator* (Herbst)
(*Charybdis*) *orientalis* Dana
(*Goniohellenus*) *truncata* (Fabricius)
(*Goniohellenus*) *vadorum* Alcock
(*Gonioneptunus*) *bimaculata* (Miers)
(*Goniosupradens*) *erythrodactyla* (Lamarck)
(*Goniosupradens*) *obtusifrons* Leene
Genus *Portunus* Weber
acerbiterminalis, new species
argentatus (A. Milne Edwards)
brockii (de Man)
dubius (Laurie)
euglyphus (Laurie)
P. gladiator complex
gladiator (Alcock)
pseudoargentatus Stephenson
granulatus (H. Milne Edwards)
hastatoides Fabricius
P. longispinosus complex
emarginatus Stephenson and Campbell
iranjae Crosnier
Genus *Portunus* Weber—Continued
P. longispinosus complex—Con.
macrophthalmus Rathbun
tenuicaudatus Stephenson
species (unidentifiable)
orbitosinus Rathbun
pelagicus (L.)
pubescens (Dana)
pulchricristatus (Gordon)
rubromarginatus (Lanchester)
cf. *rubromarginatus* (Lanchester)
rugosus (A. Milne Edwards)
sanguinolentus (Herbst)
spiniferus, new species
spinipes (Miers)
tenuipes (de Haan)
trituberculatus (Miers)
tuberculosus (A. Milne Edwards)
tweediei (Shen)
Genus *Scylla* de Haan
serrata (Forskål)
Genus *Thalamita* Latreille
admete (Herbst)
auauensis Rathbun
bouvieri Nobili
chaptalii (Audouin)
coeruleipes Jacquinot
corrugata Stephenson and Rees
crenata (Latreille)
dakini Montgomery
danae Stimpson
demani Nobili
foresti Crosnier
gatavakensis Nobili

Genus *Thalamita* Latreille—Continued
gloriensis Crosnier
granosimana Borradaile
imparimana Alcock
integra Dana
mitsiensis Crosnier
multispinosa, new species
oculea Alcock
parvidens (Rathbun)
philippinensis, new species
picta Stimpson
pilumnoides Borradaile
poissonii (Audouin and Savigny)
prymna (Herbst)
Genus *Thalamita* Latreille—Continued
pseudopoissoni, new species
quadrilobata Miers
sexlobata Miers
sima H. Milne Edwards
spinifera Borradaile
spinimana Dana
spinimera, new species
stephensoni Crosnier
stimpsoni A. Milne Edwards
Genus *Thalamitoides* A. Milne Edwards
quadridens A. Milne Edwards
tridens A. Milne Edwards

Subfamily PODOPHTHALMINAE Borradaile

Genus *Podophthalmus* Lamarck
vigil (Weber)

Subfamily CATOPTRINAE Borradaile, 1907

Genus *Carupa* Dana, 1851

Carupa tenuipes Dana

Carupa tenuipes Dana, 1851, p. 129; 1852a, p. 85; 1852b, pp. 279–280.—Leene, 1940, pp. 165–168, figs. 1, 2.—Stephenson and Campbell, 1960, p. 88, pl. 2 (fig. 1).—Crosnier, 1962, pp. 19–20, figs. 16–23, pl. 1 (fig. 1).—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

Carupa laeviscula Heller, 1862, p. 520; 1865, p. 27, pl. 2 (fig. 2).—Alcock, 1899, p. 26.—Leene, 1938, pp. 9–10.—Sakai, 1939, p. 373, pl. 44 (fig. 3).—Edmondson, 1954, pp. 226–227, figs. 3b, 4e, 4f, 4g.

MATERIAL.—Melanesia: Mariemberg, New Guinea, May 10, 1929, Albert W. Herre, 1 female.

Marianas: Saipan, coral heads, 1945, A. H. Banner, 1 male.

Marshalls: Lagoon reef, Latoback Is., Rongarik, Aug. 18, 1947, F. M. Bayer, F. C. Zimmerman, 1 male; Aug. 21, 1947, 1 male.

Hawaii: Waikiki Marine Lab., Honolulu, under stones near shore, Feb. 9, 1942, G. S. Mansfield, 1 female.

Tuamotus and Societies: Sta. 29a–57, outer reef, Tickahau Atoll, Maiai Is.; Apr. 14, 1957, Bredin Exped., 1 female; Huahine Is., head of Baie de Maroe, from branching coral, Apr. 30, 1957, Bredin Exped., 1 male; Huahine, off Point Teffaao, Sta. 90a–57, from dead coral, May 2, 1957, Bredin Exped., 1 female; Moorea, Society Is., outside barrier reef, 200 yds. E. of pass to Papetoai Bay, 70 ft., May 15, 1957, J. Randall, 1 female.

MEASUREMENTS.—Males, 8–11 mm.; females, 9–22 mm.

REMARKS.—Specimens resemble Crosnier's (1962) figure 16, rather than his figure 17.

DISTRIBUTION.—Madagascar to Hawaii, including Australia and Japan.

Genus *Libystes* A. Milne Edwards, 1867

See Stephenson and Campbell, 1960, p. 85, for synonymy.

Libystes truncatifrons (de Man)

Catoptrus nitidus A. Milne Edwards, 1870, p. 82.—Ortmann, 1894, p. 687.—Alcock, 1900, p. 307.—Laurie, 1906, p. 422 (in part). Rathbun, 1911, pp. 238–239.—Tesch, 1918, pp. 179–180, pl. 9 (figs. 4, 4a–d).—Sakai, 1936, p. 135, pl. 35 (fig. 2).—Balss, 1938, p. 29.—Sakai, 1939, p. 372, pl. 44 (fig. 2).

Goniocaphyra truncatifrons de Man, 1887b, p. 339, pl. 14 (fig. 1); 1890, p. 67.—Zehntner, 1894, p. 163, pl. 8 (fig. 12).—Borradaile, 1900, p. 577.

Libystes truncatifrons (de Man).—Stephenson and Campbell, 1960, pp. 85–86 (in key).—Crosnier, 1962, pp. 16–17, figs. 11–15.

?*Catoptrus nitidus* A. Milne Edwards.—Edmondson, 1946, p. 277; 1954, p. 224, figs. 2e–g.

MATERIAL.—Tuamotus and Societies: Both coll. Bredin Exped., Huahine Is., Sta. 84a–57, head of Baie de Maroe, from branching coral, Apr. 5, 1957, 1 male (6 mm.). Tickahau Lagoon, Sta. 10a–57, Apr. 11, 1957, 1 ovig. female (9 mm.).

REMARKS.—If Tesch (1918, pp. 177–178) is correct in stating that there are no reasons for maintaining the genus *Catoptrus* A. Milne Edwards, 1870, then the above synonymy follows.

Serene (pers. comm.) has drawn our attention to Barnard's suggestion (1954, p. 100) that *C. inequalis* Rathbun (1906), which is very close to the present species, may be a synonym of *L. edwardsi* Alcock (1900).

The male abdomen resembles that figured by Crosnier (1962, fig. 14); unfortunately no male pleopods are present so that Edmondson's (1954) figures 2f and g cannot be checked.

DISTRIBUTION.—Madagascar to Hawaii, including Mauritius, Amirante, Coetivy, Ceylon, Amboina, Batavia, Japan, Samoa, and Fiji.

Subfamily MACROPIPINAE Stephenson and Campbell, 1960

Genus *Parathranites* Miers, 1886

Parathranites orientalis (Miers)

Lupocyclus (*Parathranites*) *orientalis* Miers, 1886, pp. 186–187, pl. 17 (figs. 1, 1a, b, c).

Parathranites orientalis (Miers).—Alcock, 1899, pp. 17–18.—Sakai, 1939, pp. 376–377, pl. 43 (fig. 2).—Barnard, 1950, pp. 148, 149, figs. 29 i–l.—Stephenson, 1961a, pp. 97–98, figs. 1B, 2H, pls. 1 (fig. 2), 4B.—Crosnier, 1962, p. 22, fig. 24.

MATERIAL.—Philippines: Sta. 5154, Bakun Point, 5°14′50″N., 119°58′45″E., 12 fm., coarse sand, Feb. 19, 1908, *Alb.*, 1 fragmented female (ca. 18 mm.).

DISTRIBUTION.—Madagascar, Seychelles, Ki Is., Admiralty Is., India, Andamans, Solomon Bank, Japan, and eastern Australia.

Subfamily CAPHYRINAE Alcock, 1899

Genus *Caphyra* Guérin, 1832

Caphyra rotundifrons (A. Milne Edwards)

Camptonyx rotundifrons A. Milne Edwards, 1869, p. 156, pl. 7 (figs. 11, 12).
Caphyra rotundifrons (A. Milne Edwards).—Stephenson and Campbell, 1960, pp. 101–102, figs. 1H, 2J, 3A–C, 3K, pls. 3 (fig. 4), 5J.—Crosnier, 1962, p. 30, fig. 39, pl. 1 (fig. 2).

MATERIAL.—Tuamotus and Societies: Matu Uta Is., Papeete Harbor, Tahiti, Sta. 42–57, outer reef, Apr. 20, 1957, Bredin Exped., 1 male (7 mm.); Sta. 62–57, Bora Bora, inner edge of outer reef, Apr. 25, 1957, Bredin Exped., 1 female (7 mm.).

DISTRIBUTION.—Mauritius to Fiji and Marianas, including Australia.

Genus *Lissocarcinus* Adams and White, 1849

Lissocarcinus orbicularis Dana

Lissocarcinus orbicularis Dana, 1852a, p. 288, pl. 18 (figs. a–e); 1852b, p. 86.—Alcock, 1899, pp. 20–21.—Leene, 1938, p. 7.—Sakai, 1939, pp. 379–380, pl. 45 (fig. 1).—Barnard, 1950, pp. 145–146, fig. 28g.—Edmondson, 1954, p. 230, fig. 6b.—Stephenson and Campbell, 1960, pp. 95–96, pl. 3 (fig. 2.)—Forest and Guinot, 1961, p. 27, figs. 15a, b, 16.—Crosnier, 1962, pp. 25–27, figs. 26, 27, 31.

MATERIAL.—Hawaii: All from or near the Waikiki Marine Lab., Honolulu, in 1942; March 22, G. S. Mansfield, 1 male, 1 female; April 30, G. S. Mansfield, 1 female; May 22, G. S. Mansfield, 1 male (damaged); May 23, Mansfield and Bonne, 2 females (1 ovig.); May 30, 1 male.

Tuamotus and Societies: All coll. Bredin Exped. 1957; Sta. 13–57 Tikahau Atoll, from *Holothuria atra*, ocean reef, April 12, 1 female (damaged); Sta. 77–57 Uturoa, Raiatea, 1–3 ft., April 28, 1 female; Sta. 79–57, Taoru Is., Raiatea, reef near shore, shallow water, April 29, 1 male, 1 female; Sta. 84–57, head of Baie de Maroe, Huahine, from holothurian, sandy shoal, 2–3 ft., April 30, 1 male; Sta. 86–57, Baie de Bourayne, Huahine, sandy reef, May 1, 1 male.

MEASUREMENTS.—Males, 7–10 mm.; females, 8–12 mm.; ovig. female, 9 mm.

REMARKS.—After prolonged preservation, no traces of pigmentation remained.

DISTRIBUTION.—Africa to Hawaii and Tuamotus, including Australia and Japan.

Subfamily PORTUNINAE Stephenson and Campbell, 1960

Genus *Charybdis* de Haan, 1833

Subgenus *Charybdis* de Haan, 1833

Charybdis (*Charybdis*) *anisodon* (de Haan)

Portunus anisodon de Haan, 1835, p. 42.

Charybdis (*Charybdis*) *anisodon* (de Haan).—Leene, 1938, pp. 64–67, figs. 29, 30.—Stephenson, Hudson, and Campbell, 1957, p. 493, pl. 1 (fig. 1).—Crosnier, 1962, pp. 81–82, figs. 141–142, pl 6 (fig. 1).

Charybdis anisodon (de Haan).—Sakai, 1939, pp. 405–406.

MATERIAL.—Malay Peninsula: Cham Han Bight, Siam, Jan. 9, 1924, H. M. Smith, 1 male, Chantabun River at Lem Sing, Siam, May 7, 1927, H. M. Smith, 2 females; Thailand, Sta. 26, entrance to Trat Bay, Gulf of Thailand, flat mud bottom, 11°58′30″N., 102°44′05″E., 5 m., Oct. 29, 1957, GVF, 1 male; Sta. 27, east coast, Gulf of Thailand, S. of Trat Bay off Lam Son Village near Cambodian border, 11°57′00″N., 102°44′45″E., 10 m., Oct. 29, 1957, GVF, 2 males; Thailand, anchorage in Mae Nam Chantaburi River at Tha Chalaep Harbor, Chantaburi Province, Sta. 134, Dec. 24, 1957, GVF, 1 female.

Philippines: Manila Bay, Dec. 7, 1907, *Alb.*, 1 male; Manila Bay, outside of breakwater, mud, small rocks, Dec. 12, 1907, *Alb.*, 1 male; Tacloban Anchorage, about ship, hand dredge, 3 fm., Apr. 12, 1908, *Alb.*, 2 males (1 fragmented), 1 female.

MEASUREMENT.—Males, 12–45 mm.; females, 13–28 mm.

REMARKS.—In larger males the borders of ultimate and penultimate abdominal segments form an uninterrupted curve instead of the indented separation shown by Crosnier (1962, fig. 142).

DISTRIBUTION.—Madagascar and Red Sea to New Caledonia, Japan, and Australia.

Charybdis (*Charybdis*) *callianassa* (Herbst)

?*Cancer callianassa* Herbst 1789, pl. 54 (fig. 7) (fide Leene, 1938).

Charybdis (*Goniosoma*) *callianassa* (Herbst).—Chopra, 1935, pp. 489–491, fig. 11, pl. 9 (fig. 1).

Charybdis (*Charybdis*) *callianassa* (Herbst).—Leene, 1938, pp. 81–84, figs. 41–43.—Stephenson, Hudson, and Campbell, 1957, pp. 493–495, figs. 1B–D, 2C, 3D, pls. 1 (fig. 2), 4A.

MATERIAL.—Malay Peninsula: East coast Gulf of Thailand, S. of

Trat Bay off Lam Son Village, near Cambodian border, 11°57′00″N., 102°44′45″E. GVF Sta. 27, Oct. 29, 1957, 1 male (without chelipeds) (32 mm.).

DISTRIBUTION.—Karachi to eastern Australia.

***Charybdis (Charybdis) curtilobus*, new species**

PLATE 1A

MATERIAL.—Philippines: Sta. 5594, near Mount Putri, 4°14′20″N., 117°53′12″E., 11 fm., Sept. 30, 1909, *Alb.*, 1 female (21 mm., holotype, cat. no. 111729).

DESCRIPTION—Front: 6-toothed. Medians rounded, protruding slightly beyond submedians, separated by narrow incision. Submedians broader, lobelike, with inner border curved and outer border running straight backward. Laterals roundedly triangular. Front distinctly separated from and prominent beyond inner supraorbital angles. These strongly arched and short (about as broad as lateral frontal lobes).

Anterolateral teeth: Six. First four stout and square cut, but with distinct anterior points becoming sharper in more posterior teeth. Fifth tooth sharp and the smallest. Sixth distinctly the largest.

Carapace: Relatively broad, B./L.=1.7. Posterolateral borders strongly convergent forming curve with nearly straight posterior border. Bearing sparse pile of fine hairs on frontal and lateral portions, microscopically granular throughout. Following ridges present: Frontals (short), protogastrics (convex anteriorly), mesogastrics (continuous sinuous line), epibranchials (interrupted at cervical groove but not in midline), cardiac (obscure), anterior mesobranchial (short, oblique), posterior mesobranchial (forward surface only ridgelike, remainder an extensive granulated area).

Chelipeds: Right larger. Granular and pilose on upper and outer surfaces. Anterior border arm with two spines, posterior border smooth. Wrist normal. Upper surface palm with two granular carinae terminating in spines about four-fifths distance along segment. Outer surface with three carinae, uppermost the most granular. Inner surface with ill-developed, smooth, central carina. Under surface microscopically granular.

Fifth leg: Merus short (L./B.=1.7), with posterior spine.

REMARKS.—This species resembles *C. rathbuni* Leene (1938, pp. 97–99, fig. 52) but differs as follows:

a. Broader carapace (B./L. ca. 1.7 instead of ca. 1.4) due mainly to the longer last anterolateral tooth.

b. Narrower inner orbital lobe which is not much wider than the lateral frontal lobe. The specific name refers to this feature.

c. Center of mesobranchial areas of carapace is covered with a large diffusely granular area which has no counterpart in *C. rathbuni*. This effectively obliterates the two most posterior mesobranchial ridges.

d. Only two spines on upper surface of palm (excluding that at wrist articulation) against four in *C. rathbuni*.

***Charybdis (Charybdis) feriatus* (Linnaeus)**

Cancer feriatus L. 1758, p. 627 (fide Holthius, 1962, pp. 234–235).
Cancer cruciatus Herbst, 1790, pl. 8 (fig. 53) (fide Alcock, 1899).
Charybdis (Charybdis) cruciata (Herbst).—Leene, 1938, pp. 24–27, figs. 1, 2.—Stephenson, Hudson, and Campbell, 1957, pp. 495, 497, figs. 2E, 3F, pls. 1 (fig. 3) 4B.—Crosnier, 1962, pp. 75–77, figs. 130–132.
Charybdis cruciata (Herbst).—Sakai, 1939, pp. 403–404, pl. 82 (fig. 3).—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

MATERIAL.—Malay Peninsula: Sta. 10001, from Thailand, purchased, received Aug. 24, 1955, R. E. Elbel, 1 male (120 mm.); Thailand, NE. of Goh Krah I., middle of Gulf of Thailand, 08°38.2′N., 101°14.6′E., GVF Sta. 40, Oct. 31, 1957, 1 male (55 mm.).

REMARKS.—Justifications for changing the long-accepted name of this species are given by Holthius (1962).

DISTRIBUTION.—Madagascar, South Africa, India, to Japan and Australia.

***Charybdis* cf. *feriatus* (Linnaeus)**

MATERIAL.—China: Namru–2, Taipei, 12 mi. S. of Tau Hsui, Sta. AT–51, beach, 1957, R. E. Kuntz, 1 male (27 mm.).

REMARKS.—Probably a juvenile, as evidenced by the flexibility of the male pleopods. With many features of *C. feriatus*, except the basal antennal joint does not touch the front.

***Charybdis (Charybdis) hellerii* (A. Milne Edwards)**

Goniosoma hellerii A. Milne Edwards, 1867, p. 282.
Charybdis (Goniosoma) merguiensis Chopra, 1935, pp. 484–486, fig. 8.
Charybdis (Charybdis) hellerii (A. Milne Edwards).—Leene, 1938, pp. 44–49, figs. 15–17.
Charybdis merguiensis Chopra.—Barnard, 1950, p. 168, figs. 27d, 32b.
Charybdis hellerii (A. Milne Edwards).—Edmondson, 1954, pp. 247–248, figs. 32e, f.
Charybdis (Charybdis) helleri (A. Milne Edwards).—Stephenson, Hudson, and Campbell, 1957, pp. 497–498, figs. 1A, 2I, 3J, pls. 1, (fig. 4), 4C, 5B.—Crosnier, 1962, pp. 77–78, figs. 133–135, pl. 5 (fig. 1).

MATERIAL.—Malay Peninsula: Rangoon, Burma, Gordon E. Gates, 1 male (35 mm.).

Melanesia: Sta. 4, Bougainville I., received Jan. 10, 1945, W. A. Bartos, 1 female (72 mm.).

DISTRIBUTION.—Mediterranean and East African coast to Hawaii, including Australia.

Charybdis (*Charybdis*) *japonica* (A. Milne Edwards)

Goniosoma japonicum A. Milne Edwards, 1861, p. 373.
Charybdis (*Charybdis*) *japonica* (A. Milne Edwards).—Leene, 1938, pp. 30–35, figs. 5–7.
Charybdis japonica (A. Milne Edwards).—Sakai, 1939, pp. 400–401, pl. 45 (fig. 5).—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

MATERIAL.—China: Tan Shui Beach, northwest coast of Taiwan, Aug. 15, 1965, R. E. Kuntz, 1 male.

Japan: Tangku, Fan Memorial Institute of Biology, May 8, 1929, C. J. Shen (coll. and ident.), 1 male, 1 female.

MEASUREMENTS.—Males, 34, 63 mm.; female, 73 mm.

DISTRIBUTION.—Red Sea, China, and Japan. As Leene notes, the absence of specimens from intermediate localities is surprising.

Charybdis (*Charybdis*) *miles* (de Haan)

Portunus (*Charybdis*) *miles* de Haan, 1835, p. 41, pl. 11 (fig. 1).
Charybdis (*Charybdis*) *miles* (de Haan).—Leene, 1938, pp. 38–42, figs. 10–13.—Stephenson, Hudson, and Campbell, 1957, pp. 500–501, figs. 2H, 3I, pls. 2 (fig. 3), 4F.
Charybdis miles (de Haan).—Sakai, 1939, p. 405, pl. 46 (fig. 2).—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

MATERIAL.—Philippines: Sta. 5442, west coast of Luzon, South Fernando Point Light, 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 1 female (22 mm.).

DISTRIBUTION.—India to Japan and Australia, including South China Sea and Hong Kong.

Charybdis (*Charybdis*) *natator* (Herbst)

Cancer natator Herbst, 1789, pl. 40 (fig. 1) (fide Leene, 1938).
Charybdis (*Charybdis*) *natator* (Herbst).—Leene, 1938, pp. 93–97, figs. 50, 51.—Stephenson, Hudson, and Campbell, 1957, pp. 501–502, figs. 2G, 3H, pls. 2 (fig. 4), 4J.—Crosnier, 1962, pp. 82–83, figs. 143–144, pl. 13 (fig. 2).
Charybdis natator (Herbst).—Sakai, 1939, p. 407.—Barnard, 1950, pp. 169–170.

MATERIAL.—Malay Peninsula: Singapore, Mar. 20, 1934, Herre collection, 1 male.

Australia: Low tide, Little Lagoon, Groote Eylandt, on sand bar, about one-fourth mile from south shore, speared by native, May 11, 1948, 1 male.

MEASUREMENTS.—Males, 55, 98 mm.

DISTRIBUTION.—Southeast Africa to Japan and Australia.

Charybdis (*Charybdis*) *orientalis* Dana

Charybdis orientalis Dana, 1852a, p. 285, pl. 17 (fig. 10); 1852b, p. 85.—Sakai, 1939, pp. 407–408, pl. 83 (fig. 2).

Charybdis (*Charybdis*) *orientalis* Dana.—Leene, 1938, pp. 68–72, figs. 32–34 (excluding some synonymy).—Stephenson, Hudson, and Campbell, 1957, pp. 502–503, figs. 2B, 3B, pls. 3 (fig. 1), 4G.—Crosnier, 1962, pp. 80–81.
Not *Charybdis orientalis* Edmondson, 1946, p. 281, fig. 173e (=*C. hawaiensis*).

MATERIAL.—China: Tan Shui Beach, northwest coast of Taiwan, Aug. 15, 1956, R. E. Kuntz, 1 female (44 mm.).

DISTRIBUTION.—Madagascar and East Africa to Japan and Australia.

Subgenus *Goniohellenus* Alcock, 1899

Charybdis (*Goniohellenus*) *truncata* (Fabricius)

Portunus truncatus Fabricius, 1798, p. 365 (fide Leene, 1938).
Charybdis (*Goniohellenus*) *truncata* (Fabricius).—Leene, 1938, pp. 118–121, figs. 66, 67.—Stephenson, Hudson, and Campbell, 1957, pp. 503–504, figs. 2D, 3E, pls. 3 (fig. 3), 4I.—Stephenson, 1961a, p. 117.—Crosnier, 1962, pp. 87, 89, figs. 149–150, pl. 8 (fig. 1).—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

MATERIAL.—Philippines: Sta. 5442, west coast of Luzon, South Fernando Point Light, 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 1 male (23 mm.).

DISTRIBUTION.—Madagascar, Ceylon, India, Japan, Philippines, and Australia.

Charybdis (*Goniohellenus*) *vadorum* Alcock

Charybdis (*Goniohellenus*) *hoplites* var. *vadorum* Alcock, 1899, p. 67.
Charybdis (*Goniohellenus*) *vadorum* Alcock.—Leene, 1938, pp. 114–117, figs. 63–65.

MATERIAL.—Philippines: Sta. 5442, west coast of Luzon, South Fernando Point Light, 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 1 male (17 mm.), 1 female (21 mm.).

REMARKS.—The carapace ornamentation is slightly different from that figured by Leene, the mesobranchial granulated areas being distinctly separated from the posterolaterals. The frontal incisions separating the lateral frontal teeth from the remainder are deep and relatively broad, more so than Leene's figure 63. This causes difficulties in her key (pp. 22–23).

DISTRIBUTION.—Red Sea and Persian Gulf to Hong Kong.

Subgenus *Gonioneptunus* Ortmann, 1893

Charybdis (*Gonioneptunus*) *bimaculata* (Miers)

Goniosoma variegatum var. *bimaculatum* Miers, 1886, p. 191, pl. 15 (fig. 3).
Charybdis (*Gonioneptunus*) *bimaculata* (Miers).—Leene, 1938, pp. 126–129, figs. 70, 71.—Stephenson, Hudson, and Campbell, 1957, pp. 504–505, figs. 2J, 3K, pls. 3 (fig. 4), 4H, 5A.

Charybdis bimaculata (Miers).—Sakai, 1939, pp. 410–412, figs. 10, 11.—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).
Charybdis (*Gonioneptunus*) *subornata* (Ortmann).—Leene, 1938, pp. 122–125, figs. 68, 69.
Charybdis (*Gonioneptunus*) *whiteleggei* (Ward).—Leene, 1938, pp. 125–126.

MATERIAL.—Philippines: Sta. 5391, Tubig Point, Destacado I., 12°13′05″N., 124°05′03″E., 118 fm., Mar. 13, 1909, *Alb.*, 1 female (15 mm.).

REMARKS.—As indicated by Sakai (1939, pp. 410–412), *C. subornata* is probably a synonym of *C. bimaculata*. Stephenson, Hudson, and Campbell (1957, pp. 504–505) supported this synonymy, adding *C. whiteleggei*. The present specimen has long last anterolateral teeth as in Leene's figure (fig. 68) of *C. subornata*.

DISTRIBUTION.—India and Maldives to Japan and eastern Australia.

Subgenus *Goniosupradens* Leene, 1938

Charybdis (*Goniosupradens*) *erythrodactyla* (Lamarck)

Portunus erythrodactylus Lamarck, 1818, p. 259.
Thalamita erythrodactyla (Lamarck).—H. Milne Edwards, 1834, p. 464.
Charybdis (*Goniosoma*) *erythrodactyla* (Lamarck).—Rathbun, 1906, p. 872, pl. 4.
Charybdis (*Goniosupradens*) *erythrodactyla* (Lamarck).—Leene, 1938, pp. 134–137, figs. 77–80.—Crosnier, 1962, p. 86, pl. 7 (fig. 1).
Charybdis erythrodactyla (Lamarck).—Sakai, 1939, pp. 408–409, pl. 83 (fig. 1).—Holthuis, 1953, p. 6.—Forest and Guinot, 1961, p. 30.

MATERIAL.—Marshalls: Outer reef, Namu I., Bikini Atoll, collected at night, by light, Aug. 7, 1947, F. M. Bayer, 2 males.

Tuamotus and Societies: Bora Bora, Farepiti Point Sta. 50–57, Apr. 23, 1957, Bredin Exped., 1 ovig. female; Sta. 126–57, reef, Nuarei Bay, Moorea, May 12, 1957, Bredin Exped., 1 male.

MEASUREMENTS.—Males, 55–94 mm.; ovig. female, 81 mm.

DISTRIBUTION.—Mauritius and Red Sea to Hawaii, Tahiti, and Marquesas, including Japan. Not recorded from Australia.

Charybdis (*Goniosupradens*) *obtusifrons* Leene

Charybdis obtusifrons Leene, 1936, p. 124, figs. 11, 12.—Sakai, 1939, pp. 409–410, pl. 83 (fig. 3).
Charybdis (*Goniosupradens*) *obtusifrons* Leene, 1938, pp. 140–143, figs. 85–87.—Sankarankutty, 1961, pp. 123–124.—Crosnier, 1962, pp. 84–85, figs. 146, 146 bis a-c, pl. 6 (fig. 2).

MATERIAL.—Melanesia: Bougainville I., received Jan. 10, 1945, W. A. Bartos, 2 males (dried) (8, 13 mm.).

REMARKS.—Because of their fragile state, detailed examination was impossible. Compared with Leene's figures and description, the differences in present specimens are: Submedian frontal teeth are broader; protogastric ridges are equidistant between frontals and

mesogastrics; and mesobranchial ridges are longer and slightly inclined.

DISTRIBUTION.—Madagascar, Red Sea, India, and Japan.

Genus *Portunus* Weber, 1795

Portunus acerbiterminalis, new species

FIGURE 1; PLATE 1B

MATERIAL.—East Africa: U–48–74 Saudi Arabia, Tarut Bay, Ras Tanura, fish pier at night, May 26, 1948, Erdmann, 1 male (fragmented, two walking legs, one fifth leg missing) (16 mm., holotype, cat. no. 112–656); U–48–89, Saudi Arabia, Tarut Bay, 1¼ mi. N. of Ras Tanura, 100 yds. offshore, June 7, 1948, Erdmann, 1 male (19 mm.), 1 female (missing most appendages, with only one left cheliped, one walking leg, one left fifth leg) (ca. 19 mm.). All specimens soft, initially formalin preserved.

DESCRIPTION.—Front: 4-lobed, upraised, protruding well beyond inner supraorbital angles. Medians much smaller, more rounded, and less projecting than laterals, which are obtusely rounded. Inner supraorbital angle very obtuse. Two fissures on upper border of orbit, both slightly open. Single suborbital fissure. Suborbital tooth reasonably prominent.

Anterolateral teeth: Nine, first blunt, remainder sharp; fourth, sixth, and eighth slightly smaller than intervening odd-numbered teeth. Ninth distinctly elongate.

Carapace: Reasonably broad, approximately twice as broad as long, with conspicuously elevated areas (some almost tubercular), separated by regions with dense pubescence. Posterior-posterolateral junction elevated, forming an obtuse or right angle. Following areas recognizable: Protogastrics diffuse and broadly separated; mesogastrics each divided into two portions, median with almost ridgelike termination, lateral with dense cluster of granules to form a tubercle; metagastric continuous across midline with ridged border; central longitudinal patch present, running from level of protogastrics but not quite confluent with metagastrics; between metagastrics and cardiacs a small, central, transverse, granular patch; paired cardiacs, conspicuously elevated, each bearing a tubercle, broadly separate in midline; median postcardiac an unusually conspicuous, tuberculate elevation; lateral postcardiacs conspicuous, but diffuse; anterolaterals, sizable patch opposite third anterolateral tooth, smaller one opposite fifth, and smaller still opposite seventh; epibranchial feebly developed laterally, well developed toward center; anterior and posterior mesobranchials present, former with short ridgelike border sometimes

tuberculate, latter variable, either diffuse or tuberculate; posterolaterals well developed, sometimes merging with posterior mesobranchials. Two additional small, paired, granular patches present, one midway between epibranchials and metagastrics, the other midway between anterior mesobranchials and cardiacs.

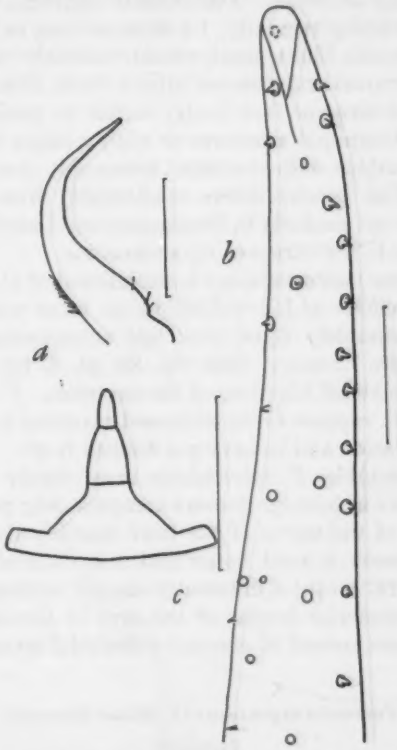

FIGURE 1.—*Portunus acerbiterminalis*, new species, male holotype: *a*, pleopod; *b*, pleopod tip, under surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.1 mm.; *c*, 5 mm.)

Chelipeds: Short, stout, right stouter than left, with squamiform markings on under surface. Posterior border of arm with two well-developed spines, anterior border with four spines. Wrist with well-developed spines on inner and outer surfaces. Hand with well-developed shelflike carina separating upper from inner surface, and bearing on each left chela a terminal spine (none on right chela). Two carinae on outer surface of hand, both regularly granular, lowermost very prominent. Well-developed granular carina on inner surface of hand. Fingers short, stout but thin.

Fifth leg: Merus, relatively stout (B/L ca. 1.5), posterodistal border coarsely serrated.

Third maxilliped: Anteroexternal angle conspicuously expanded in lateral direction.

Male abdomen: Elongate, ultimate segment lanceolate with rounded tip, twice as long as broad. Penultimate segment, distally parallel sided, then converging regularly, 1.4 times as long as broad.

Male first pleopod: Short, stout, robust, smoothly but conspicuously curved. Subterminal armature on outer surface, of scattered spinules with portions of three or four (only) visible in profile view. Inner side without subterminal armature or with a single bristle in profile view. Under surface with scattered reasonably numerous spinules.

REMARKS.—This species differs considerably from *P. hastatoides*, although it keys out similarly in Stephenson and Campbell (1959). It differs obviously in the carapace ornamentation.

The strongly embossed carapace is reminiscent of *P. petreus*, but the present species differs as follows: Spines on inner and outer sides of wrist are approximately equal size; last anterolateral tooth is distinctly longer (see Crosnier, 1962, fig. 86, pl. 4, fig. 1); has angled posterior-posterolateral junctions of the carapace.

It resembles *P. rugosus* in its embossed carapace but differs in the details of granulation and in having a 4-lobed front.

It possibly resembles *P. tuberculosus* more closely than any other species but differs in having: A more conspicuously produced anteroexternal border of the merus of the third maxilliped; less protruding median frontal teeth; a much larger first anterolateral tooth; a longer ninth anterolateral tooth; a differently shaped epibranchial carapace ridge; and the posterior border of the arm of the cheliped bearing two distinct spines instead of one and a doubtful second.

Portunus argentatus (A. Milne Edwards)

FIGURE 2

Amphitrite argentata White, 1847, p. 146 (descriptio nulla).
Neptunus argentatus A. Milne Edwards, 1861, pp. 332, 339, pl. 31 (figs. 4, 4a, 4b).
Portunus (Achelous) argentatus (A. Milne Edwards).—Rathbun, 1906, p. 871.—Edmondson, 1954, pp. 238–239, figs. 14, 15.
Portunus argentatus (A. Milne Edwards).—Stephenson, 1961a, pp. 105–106, figs. 1F, 3D, pls. 2 (fig. 2), 4D, 5A.—Crosnier, 1962, pp. 50–51, figs. 71, 75, 77, 80, 81, pl. 3 (fig. 1).

MATERIAL.—As indicated below, two forms are distinguishable in adult males, designated forms A and B respectively. These are listed separately, as are females and juveniles.

MALES (FORM A)

China: Sta. 5308, China Sea, vicinity Hong Kong, 21°54′N., 115°42′E., 62 fm.; Nov. 4, 1908, *Alb.*; 1 *Sacculina* infected male; Sta. 5309, China Sea, vicinity Hong Kong, 21°53′N., 115°51′E., 62 fm., green mud, Nov. 4, 1908, *Alb.*, 4 males.

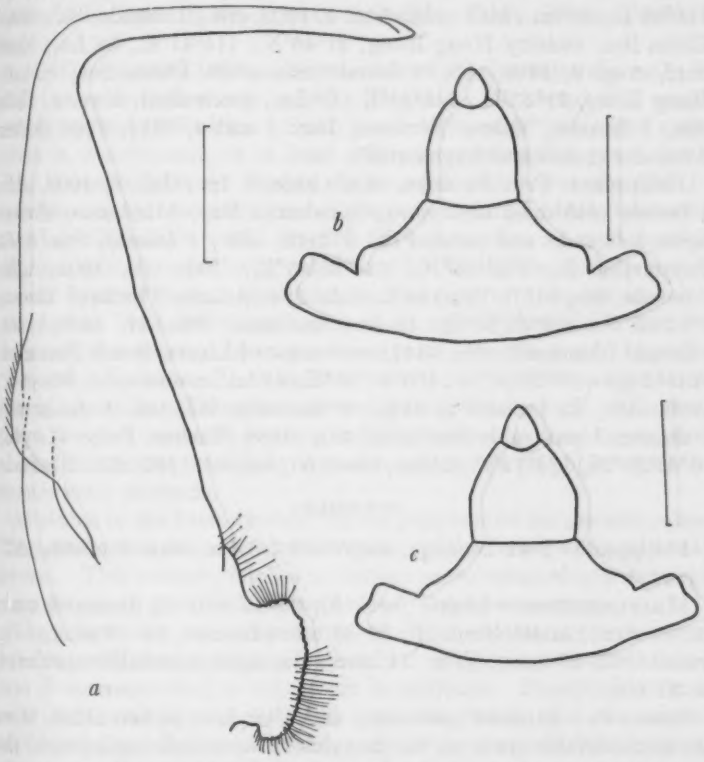

FIGURE 2.—*Portunus argentatus* (A. Milne Edwards), male: *a*, form B, pleopod, Philippines, Sta. 5442, *Alb.*, 30 mm.; *b*, abdomen, same specimen; *c*, form A, abdomen, Philippines, Sta. 5442, *Alb.*, 29 mm. (Scales=*a*, 1 mm.; *b*, *c*, 5 mm.)

Philippines: Sta. 5152, Pajumajan I., 5°22′55″N., 120°15′45″E., Feb. 18, 1908, *Alb.*, 1 male; Sta. 5442, west coast of Luzon, South Fernando Point Light, 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 16 males (1 damaged).

MALES (FORM B)

Philippines: Sta. 5442, west coast of Luzon, South Fernando Point Light, 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 3 males.

FEMALES

China: Sta. 5303, China Sea, vicinity Hong Kong, 21°44′N., 114°48′E., 34 fm., blue mud, Aug. 9, 1908, *Alb.*, 1 female; Sta. 5304, China Sea, vicinity Hong Kong, 21°46′N., 114°47′E., 34 fm., black mud, Aug. 9, 1908, *Alb.*, 1 female; Sta. 5309, China Sea, vicinity Hong Kong, 21°53′N., 115°51′E., 62 fm., green mud, Nov. 4, 1908, *Alb.*, 2 females; Takao, Formosa, Dec. 3 and 4, 1914, Fred Baker, 2 females (1 soft and fragmented).

Philippines: Port Binanga, ship's side, 6 fm., Jan. 8, 1908, *Alb.*, 1 female (deformed abdomen); Panabutan Bay, Mindanao, electric light, soft mud and sand, Feb. 5, 1908, *Alb.*, 1 female; Sta. 5152, Pajumajan I., 5°22′55″N., 120°15′45″E., Feb. 18, 1908, *Alb.*, 1 female; Sta. 5157, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′30″N., 119°55′50″E., 18 fm., fine sand, Feb. 21, 1908, *Alb.*, 1 female (damaged); Sta. 5442, west coast of Luzon, South Fernando Point Light, 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 22 females (4 ovig., 2 *Sacculina* infected, 1 damaged), 1 damaged unsexable specimen; Sta. 5480, Tacbuc Point (Leyte), 10°44′36″N., 125°19′E., 62 fm., fine sand, July 29, 1909, *Alb.*, 1 female.

JUVENILES

Philippines: Port Binanga, ship's side, 6 fm., Jan. 8, 1908, *Alb.*, 2 juvs.

Measurements.—Males (form A), 21–39 mm. (1 damaged male, ca. 40 mm.); males (form B), 30–33 mm.; females, 18–36 mm.; ovig. females, 35–37 mm.; juvs. 14 mm.; damaged unsexable specimen, ca. 27 mm.

Remarks.—In most specimens, and after long preservation, there are no detectable spots on the dactylus of the swimming legs and the general nacreous luster is far from obvious. Most males have pleopods resembling those figured and described by Stephenson (1961a) with short, curved, distally swollen appendages bearing a complex and dense subterminal armature. These possess abdomens with relatively broad, sharply converging penultimate segments.

In three cases male pleopods are quite different, with long gradually tapering appendages bent at more than a right angle near their centers, and with inconspicuous subterminal armature consisting of small spinules on the outer surface (fig. 2*a*). These possess abdomens with relatively narrow, gradually converging penultimate segments.

This second form of pleopod resembles that figured by Edmondson (1954, fig. 14 c,d), differing only in subterminal armature which Edmondson shows as a distinct row of sizable bristles on the outer surface. This form of pleopod has also been figured by Crosnier (1962, figs. 77, 80, 81). The corresponding abdomen is apparently intermediate between those mentioned above.

Apart from male pleopods and abdomens, no structural heterogeneity could be found in the present material. There are two possibilities:

a. The material belongs to two distinct species, separable only in adult males and effectively only by pleopods. To accept this would involve several difficulties. First, the two "species" would be sympatric in distribution, or at least seriously overlapping, since both occur in one collection. Second, to establish which was the true *P. argentatus* would necessarily await reexamination of Milne Edwards' material. Third, it would involve the assumption of reproductive isolation, with females being capable of fertilization with only one or another type of male. Until the detailed role of pleopods in fertilization has been determined, this must remain doubtful. Fourth, there are other cases of heterogeneity in male pleopods (e.g., *Thalamita stimpsoni*, *T. danae*, *P. orbitosinus*—see text), and these should be treated similarly. This presents particular difficulty in *P. orbitosinus* where pleopod variation is more continuous than in the present case.

b. The second possibility is that a species can be polymorphic as regards male pleopods.

As stated in the Introduction, for the purposes of the present paper, *P. argentatus* was taken as the "test case" of the concept of a portunid species. This concept implies a distinct morphological gap between other species in general facies as well as pleopod structure.

Thus there are two male forms of *P. argentatus*, form A corresponding with that figured and described by Stephenson (1961a) and form B corresponding to that given in figure 2*a*. Possibly Edmondson's (1954) and Crosnier's (1962) specimens belong to a third form, resembling form B in general shape of the pleopod, but differing in its much better developed bristles.

DISTRIBUTION.—Natal to Honolulu, including Japan and Australia.

Portunus brockii (de Man)

Neptunus brockii de Man, 1887a, pp. 328–331, pl. 13 (fig. 4).

Neptunus (*Hellenus*) *brockii* de Man.—Alcock, 1899, pp. 43–44.—Shen, 1937, p. 111, figs. 7, 8e, 8f.

Portunus brocki (de Man).—Stephenson and Campbell, 1959, pp. 106–107, figs. 2G, 3G, pls. 2 (fig. 3), 4G, 5G.

MATERIAL.—Philippines: Subig Bay, China Sea, off southern Luzon, shore, seine, sand, Jan. 7, 1908, *Alb.*, 1 male; Sta. 5160, Tinakta

I., Sulu Archipelago, Tawitawi Group, 5°12′40″N., 119°55′10″E., 12 fm., sand, Feb. 22, 1908, *Alb.*, 1 male; Catabata, Mindanao, below mouth of river, seine, May 20, 1908, *Alb.*, 1 male; Port San Vicente, 130 ft. seine, Nov. 18, 1908, *Alb.*, 1 male, 1 ovig. female; Buena Vista, Guimaras Is., Iloilo Strait, seine in mouth of river, Jan. 14, 1909, *Alb.*, 1 male; near Mariveles, Luzon, 1913, A.M. Reese, 1 male.

Palau: Sta. 12–832, Madalai district, west end of Koror I., mangrove shore grading into mud and sand flat, July 9, 1955, GVF, 1 male.

Measurements.—Males, 12–29 mm.; ovig. female, 15 mm.

Remarks.—A male "16 mm., Port San Vicente, Nov. 18, 1908 *Alb.*" has a very broad, female-like abdomen, but fully developed male pleopods are present.

Distribution.—Amboina, Andamans, Singapore, and Australia.

Portunus dubius (Laurie)

Figure 3; Plate 2a

Neptunus (*Achelous*) *dubia* Laurie, 1906, pp. 416–417, fig. 9.

Material.—Philippines: Sta. 5140, Jolo Lt., 6°08′45″N., 121°03′E., 76 fm., fine coral sand, Feb. 15, 1908, *Alb.*, 1 female (13 mm.); Sta. 5432, Corandagos I., 10°37′50″N., 120°12′E., 51 fm., Apr. 8, 1909, *Alb.*, 1 male (12 mm.).

Description.—Front: Protruding beyond inner supraorbital angles and 4-toothed. Teeth sharp and directed dorsally, laterals the larger and inclined outward. Inner supraorbital angles rounded, upper border of orbit with single fissure, lower border with acute forward-directed tooth.

Anterolateral teeth: Nine, first the stoutest, gradually decreasing in size with eighth the smallest and ninth slightly larger.

Carapace: Very long, breadth about 1.3 times length. Surface microscopically granular among which major patches of granules are visible. Protogastrics diffuse and merging with ill-developed mesogastrics, which in turn connect by a central granular line to transversely situated metagastrics. Patch behind orbit in line with third anterolateral tooth; further diffuse patch opposite fourth to ninth teeth, and merging with epibranchial. Paired cardiac merges with median postcardiac. Pair of lateral postcardiacs. Mesobranchials large and diffuse but terminates abruptly on posterolateral margins by granular ridges.

Fifth leg: Merus short, length 1.8 times breadth, and with finely denticulated posterior margin. Propodus with fine hairs but no spines.

Third maxilliped: Hirsute and produced laterally.

Male abdomen: Penultimate segment with regularly tapering sides, ultimate segment triangular.

Male first pleopod: Grossly swollen so that normal distinction between basal and terminal elongate portions cannot be made. Inner side curves regularly and bears forwardly directed bipinnate bristles along half its length. Outer surface bears conspicuous flattened lobe thinly beset with elongate bipinnate bristles or hairs, these extending to upper surface where they are denser. Appendage terminates

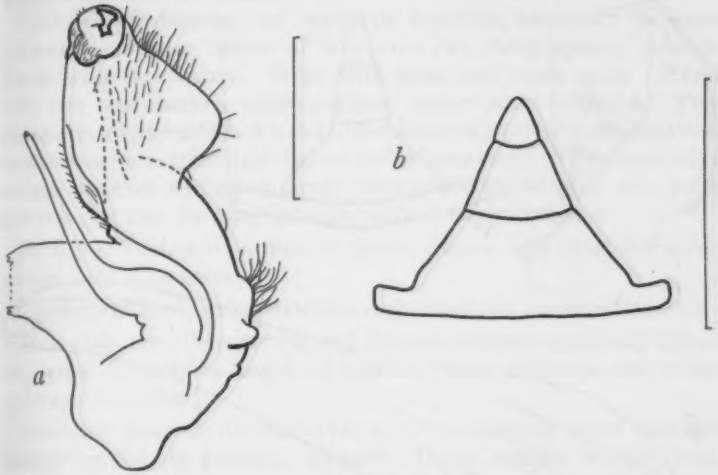

FIGURE 3.—*Portunus dubius* (Laurie), male, Philippines, Sta. 5432, *Alb.*: *a*, pleopod; *b*, abdomen. (Scales=*a*, 1 mm.; *b*, 5 mm.)

abruptly and bears subterminal aperture directed upward. Folds of cuticle surrounding this aperture give a rosette appearance and are densely covered with minute inwardly directed spinules.

REMARKS.—This species resembles *P. orbicularis* (Richters) which has been redescribed recently by Crosnier (1962). It differs in possessing a spiniform front, more granular carapace, and a male pleopod which is different from all other known species of the genus.

The abdomen of the single male in the present collection is narrower, and the ultimate segment is longer than figured by Laurie (1906, fig. 9).

DISTRIBUTION.—Previously from Gulf of Manaar and Negombo, Ceylon.

***Portunus euglyphus* (Laurie)**

FIGURE 4; PLATE 2B

Neptunus (*Amphitrite*) *euglyphus* Laurie, 1906, pp. 413–414, figs. 6, 7.

Portunus (*Achelous*) *granulatus* Edmondson, 1954, p. 239, figs. 16a, b (not fig. 17a).

Not *Lupea granulata* H. Milne Edwards, 1834, p. 454.

MATERIAL.—Philippines: Guijulugan, Negros, shore seine, Apr. 2, 1908, *Alb.*, 1 male (19 mm.); Paluan Bay, Mindoro, 130 ft. seine, Dec. 11, 1908, *Alb.*, 1 male (18 mm.).

DESCRIPTION.—Front: 4-lobed, outer lobes roundedly triangular and protruding beyond the much smaller, similar shaped medians.

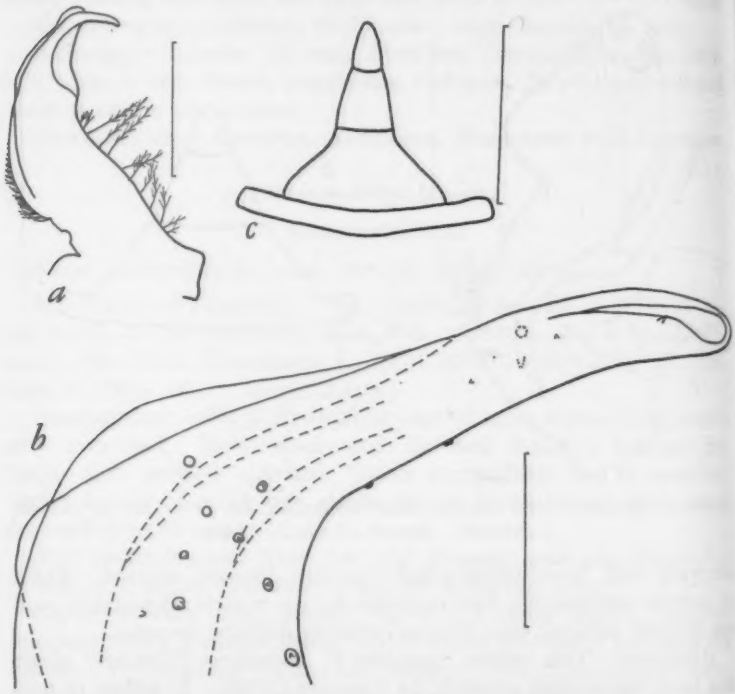

FIGURE 4.—*Portunus euglyphus* (Laurie), male, Philippines, Guijulugan, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.1 mm.; *c*, 5 mm.)

These merge with epistomial projection so that in some views front appears 3-lobed. Inner orbital angle short. Two incisions on upper border and rounded tooth on lower.

Anterolateral teeth: Anterolateral borders practically straight. First tooth relatively stout, fourth and fifth the smallest, then increasing in size to ninth, much the largest. Apart from first, all bear sharp, forwardly directed points.

Carapace: With inconspicuous pubescence and distinct granulated areas. Frontals and orbitals poorly developed. Mesogastrics and metagastrics distinct granular transverse lines connected by broad central granular patch. Protogastrics with larger anterior and smaller posterior region, latter with ridgelike anterior boundary. Cardiacs, median postcardiac, and lateral postcardiacs all conspicuously raised, rounded, granular areas. Mesobranchials resolvable into three patches. Epibranchials and posterolaterals well developed. Posterior-posterolateral junction rounded.

Chelipeds: Pubescent and markedly granular, especially on inner surfaces. Posterior border of arm with two sharp spines, anterior border with four spines. Wrist with inner and outer spine. Hand with two well-marked outer carinae, upper being granular. Two carinae on upper surface of hand, inner being the better developed and terminating in a spine just before end of segment. No recognizable carinae on inner surface of hand, this completely covered with large rounded granules showing through fairly dense pubescence.

Fifth leg: Posterior borders of merus, carpus, and propodus ornamented only with hairs.

Third maxilliped: Anteroexternal angle markedly produced laterally.

Male abdomen: Penultimate and ultimate segment gradually tapering, latter three-fifths length of former. Male abdomen and entire undersurface shining.

Male first pleopod: Short and stout with undulating outer side and sharply curved tip pointing outward. Outer surface bearing long, and inner surface bearing shorter bipinnate hairs. Terminal armature ill developed and consisting of three or four minute spinules on upper surface and five or six on lower.

Remarks.—In its general facies this species resembles *P. gladiator* Stephenson and Campbell (1959) but differs from it in having a much shorter last anterolateral spine so that the anterolateral borders appear almost without curvature, in the absence of serrations on the posterodistal border of the fifth merus, and in possessing a male pleopod unique to the genus.

The species is probably closest to *P. granulatus*, particularly in the granular areas of the carapace and the form of male pleopod, but differs conspicuously in carapace shape, in having a longer last anterolateral tooth, and in the characteristic form of its male pleopod. Edmondson's (1954) figure 16b of this pleopod obviously refers to the present species and not to *P. granulatus*.

Distribution.—Previously known only from the Gulf of Manaar and Negombo, Ceylon, and Hawaii.

The *Portunus gladiator* Complex

Crosnier (1962) concluded that *P. pseudoargentatus* Stephenson (1961a) is synonymous with his *P. gladiator;* however, the present collection contains three specimens identical with *P. pseudoargentatus* and two identical with *P. gladiator* Crosnier. These differ in a sufficient number of small particulars for *P. pseudoargentatus* to stand as a valid species.

Crosnier suspected that numerous confusions had occurred in the past regarding *P. gladiator* and particularly that *P. gladiator* Stephenson and Campbell (1959) differed from the species he recognized under this name. Reexamination of Stephenson and Campbell's material confirms that this is so. The penultimate segment of the male abdomen in Stephenson and Campbell's species is not swollen in its distal third, and the ultimate segment is more rounded and elongate. (Note that the plates in Stephenson and Campbell are mislabelled, the male abdomen of *P. gladiator* is plate 4, figure I, not figure J.) In addition, the carapace granulation is much coarser and more obvious, with posterolaterals almost merging with mesobranchials, and these again almost merging with the epibranchials. In addition, the serrated distal border of the fifth merus bears a posterior spine, not an anterior spinous projection. Until the "true" *P. gladiator* has finally been decided upon, by reference to Fabricius type, the correct name for *P. gladiator* Stephenson and Campbell must remain undecided.

Yet other authors have described different species under *P. gladiator*. Thus the shape of the male abdomen figured by Sakai (1939, fig. 5a) differs from those figured similarly by Shen (1937, fig. 2b) and Crosnier (1962, fig. 72), and described by Alcock (1899) and Barnard (1950). Sakai's figure is identical with that of *P. pseudoargentatus* Stephenson (1961a, pl. 4F), and his colored plate (pl. 47, fig. 3) is generally similar to *P. pseudoargentatus* and specifically bears an identical pigmentation of the propodus and dactylus of the fifth leg. It is concluded that *P. gladiator* Sakai and *P. pseudoargentatus* are synonyms.

De Haan's (1835) description and figures of *Portunus* (*Amphitrite*) *gladiator* appear to resemble *P. pseudoargentatus* more closely than *P. gladiator* Crosnier in possessing a parallel-sided male abdomen. The position as regards shape of the merus of the fifth leg is more ambiguous. The left side of de Haan's plate 1, figure 5, shows a relatively broad merus, approximating to *P. gladiator* Crosnier and the right side a relatively elongate one, approximating to *P. pseudoargentatus* (see p. 25). Because de Haan's plate shows pigmentation of the fifth leg resembling that of *P. pseudoargentatus* and because the

last anterolateral tooth points in a similar direction, his species is here regarded (tentatively) as being a synonym of *P. pseudoargentatus*.

***Portunus gladiator* (Alcock)**

Neptunus (*Amphitrite*) *gladiator* Alcock, 1899, pp. 35–36.—Shen, 1937, pp. 101–103, figs. 2a–c.

Monomia gladiator Barnard, 1950, p. 156.

Portunus gladiator Crosnier, 1962, pp. 51–54, figs. 72, 76, 78, 82–83, pl. 3 (fig. 2).

?*Portunus gladiator* Fabricius, 1798, p. 368.

Not *Portunus gladiator* Stephenson and Campbell, 1959, pp. 110–111, figs. 2J, 3J, pls. 3 (fig. 2), 4I, 5J.

MATERIAL.—Africa: Natal, from W. F. H. Rosenberg, 1 male (70 mm.), 1 female (66 mm.).

***Portunus pseudoargentatus* Stephenson**

Portunus (*Amphitrite*) *gladiator* De Haan, 1835, p. 39, pl. 1 (fig. 5).

Neptunus (*Amphitrite*) *gladiator* Sakai, 1939, pp. 390–391, text-fig. 5a, pl. 47 (fig. 3).

Portunus pseudoargentatus Stephenson, 1961a, pp. 109–111, figs. 2A, 3F, pls. 2 (fig. 4), 4F, 5D.

?*Portunus gladiator* Fabricius, 1798, p. 368.

MATERIAL.—Philippines: Lembeh Strait, Celebes, June 14, 1929, Herre collection, 1 male (25 mm.).

Japan: Fukura, Awaji, Y. Hirase, 1 female (28 mm.); Shimizu, Suruga, shore, Oct. 14, 1906, *Alb.*, 1 male (20 mm.).

REMARKS.—This species differs in the following details from *P. gladiator*, as described and figured by Crosnier (1962) (the comparison has been facilitated by Crosnier's kindness in forwarding one of his named specimens):

a. A more strongly embossed carapace with coarser granulation. In particular the cardiac, lateral postcardiacs, posterolaterals, and two mesobranchials are larger and less diffuse than in *P. gladiator*.

b. Form of male abdomen. The ultimate segment relatively longer and without concave lateral borders, penultimate segment not swollen in distal third.

c. Relatively narrower fifth merus. In *P. pseudoargentatus* breadth is about 0.75 times length, in *P. gladiator* about 0.9 times.

d. Differently armed anterodistal border of fifth merus. In *P. pseudoargentatus* it is finely serrated, in *P. gladiator* it bears small but distinct teeth.

e. The last anterolateral tooth is not directed slightly posteriorly, as in *P. gladiator*.

***Portunus granulatus* (H. Milne Edwards)**

FIGURE 5

Lupea granulata H. Milne Edwards, 1834, p. 454.

Neptunus (*Achelous*) *granulatus* (H. Milne Edwards).—Alcock, 1899, pp. 45–46.—Sakai, 1939, p. 397, pl. 81 (fig. 3).

Portunus (*Achelous*) *granulatus* (H. Milne Edwards).—Rathbun, 1906, p. 871, pl. 41 (fig. 6); 1911, p. 205, pl. 15 (fig. 10).—Balss, 1938, p. 31.—Edmondson, 1954, p. 239 (in part).

Neptunus granulatus (H. Milne Edwards).—Balss, 1924, p. 3 (excluding synonymy).

Portunus granulatus (H. Milne Edwards).—Stephenson and Campbell, 1959, pp. 108–110, figs. 2I, 3I, pls. 3 (fig. 1), 4J, 5I (not pl. 4I as stated in text).—Sankarankutty, 1961a, p. 104; 1961b, p. 124.—Crosnier, 1962, pp. 57–58, figs. 89, 92, 94a, b.

Not *Portunus* (*Achelous*) *granulatus* Edmondson, 1954, figs. 16a, b = *P. euphylus* (Laurie) 1906.

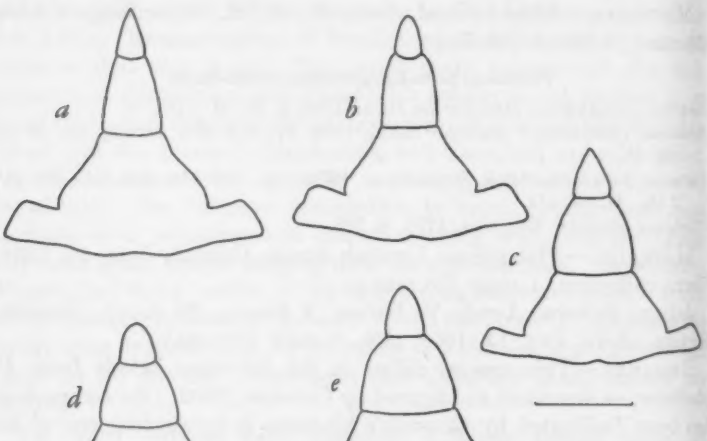

FIGURE 5.—*Portunus granulatus* (H. Milne Edwards), male abdomens: *a*, Hawaii, shallow water Mokuleia, Degener, 27 mm.; *b*, Hawaii, reef off Mokuleia, Degener, 26 mm.; *c*, Philippines, Capurmypugan Pt., *Alb.*, 26 mm.; *d*, Marianas, Agfayan Bay, Baker, 23 mm.; *e*, Philippines, Pandanon Is., Mar. 24, 1909, *Alb.*, 28 mm., right branchial area swollen. (Scale=5 mm.)

MATERIAL.—Philippines: Zamboanga, Mindanao, May 1904, Dr. E. A. Mearns, 1 male; Capurmypugan Point, Mindanao, 150 ft. seine, May 9, 1908, *Alb.*, 3 males, 1 female, 4 ovig. females; Galera Bay, Verde Is. Passage and Batanga Bay, 150 ft, seine, June 9, 1908, *Alb.*, 1 male; Tara Is., Mindora Strait, 130 ft. seine, Dec. 15, 1908, *Alb.*, 1 ovig. female; Sirinas I., Nakoola Bay, near Alphonzo XIII, Dec. 30, 1908, *Alb.*, 1 damaged male; near Sta. 5412, Pandanon Is., between Cebu and Bohol, seine, Mar. 23, 1909, *Alb.*, 1 male; Pandanon Is., between Cebu and Bohol, seine, 130 ft., Mar. 24, 1909, *Alb.*, 4 males.

Melanesia: Pacific Ser. A, received Nov. 13, 1944, Lt. George H. Penn, Malaria Control Team 28, Com. M. J. B. Rons, 7th Fleet, Advance Base 3, 1 male [Amsterdam Island, then Dutch New Guinea, coll. Aug. 15–Oct. 3, 1944, fide F. A. Chace, Jr.]; Florida I., Solomon Is., Sta. P2, Oct. 28, 1944, R. E. Kuntz, 2 females, 1 ovig. female.

Marianas: Sta. 112–65, Ajayan River, Guam, June 19, 1945, D. H. Johnson, 2 females; Sta. 110–63, Bijia Point, Guam, June 22, 1945, McElroy and Markley, 9 males, 7 females; Agfayan Bay, Guam, 145/R.H.B. 150, July 7, 1945, R. H. Baker, 5 males, 1 female; Ackang Bay, Guam, Sta. 151/R.H.B. 158, July 16, 1945, R. H. Baker, 5 males, 4 females, 1 juv.

Japan: Okinawa, Oct. 5, 1945, W. B. S. Thomas, 1 male.

Marshalls: E1–9, Arno Atoll, received 1952, Hiatt, 1 male.

Samoa: U–39–521–591, Tutuila I., reef at Alofau, June 3, 1939, L. P. Schultz, 1 male.

Hawaii: Shallow water on reef at Mokuleia, Oahu, 1938, Degener, 1 male; reef off Mokuleia, Waialua, Oahu, received June 23, 1939, Otto Degener, 2 males (1 fragmented), 1 ovig. female.

Tuamotus and Societies: East side of Papetoai Bay, Moorea, poison, shore reef, 3–20 ft., Apr. 30, 1957, J. Randall, 1 male.

MEASUREMENTS.—Males, 9–27 mm.; females, 6–21 mm.; ovig. females, 14–21 mm.; juv., 5 mm.

REMARKS.—One specimen, a large male (27 mm., Pandanon I., Mar. 24, 1909) has the right branchial cavity swollen, presumably due to a parasite, and has a broader than usual abdomen.

Crosnier has drawn attention to the remarkable variation in the form of the male abdomen. In the specimens he examined, the penultimate segment was approximately as long as broad and resembled those figured by Rathbun and Sakai; however, a penultimate segment much longer than broad is shown by Gordon and again by Stephenson and Campbell. In the present collection most of the specimens resemble Crosnier's, but these intergrade to a few others with elongate penultimate and ultimate segments (figs. 5*a–e*).

Edmondsons' *P. granulatus* is discussed under *P. euglyphus* (Laurie).

DISTRIBUTION.—Madagascar and Red Sea to Hawaii, Samoa, and Fiji, including Japan and Australia.

Portunus hastatoides Fabricius

Portunus hastatoides Fabricius, 1798, p. 368.—Stephenson and Campbell, 1959, pp. 101–102, figs. 2D, 3D, pl. 1 (fig. 4), pls. 4D, 5D.—Crosnier, 1962, pp. 68–69, figs. 96, 109, 117, 122–123.—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

Neptunus (*Amphitrite*) *hastatoides* (Fabricius).—De Haan, 1835, pp. 39–40, pl. 1 (fig. 3).

Neptunus (*Hellenus*) *hastatoides* (Fabricius).—Alcock, 1899, pp. 38–39, Sakai, 1939, pp. 391–392, pl. 47 (fig. 1).

Neptunus (*Hellenus*) *hastatoides* var. *unidens* Laurie, 1906, pp. 414–415.

Hellenus hastatoides (Fabricius).—Barnard, 1950, pp. 158–159.

MATERIAL.—China: Kowloon, electric light, Sept. 14, 1908, *Alb.*, 1 juv; Takao, Formosa, Dec. 3 and 4, 1914, F. Baker, 6 males, 1 female, 2 ovig. females.

Philippines: Sandakan Bay, Borneo, seine, Mar. 2, 1908, *Alb.*, 1 female; Sta. 5182, Antonia I., off eastern Panay, 11°36′40″N., 123°26′35″E., 26 fm., Mar. 27, 1908, *Alb.*, 1 female; Sta. 5208, Taratara I., 11°45′53″N., 124°42′50″E., 26 fm., Apr. 14, 1908, *Alb.*, 1 male; Sta. 5342, Endeavour Point, (S.), 10°56′55″N., 119°17′24″E., 12–25 fm., Dec. 23, 1908, *Alb.*, 1 male; Sta. 5360, Corregidor Lt., 14°21′N., 120°41′E., 12 fm., Feb. 8, 1909, *Alb.*, 2 females, 1 ovig. female; Sta. 5442, west coast of Luzon, South Fernando Point Light, 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 4 males, 4 females, 7 ovig. females; Sta. 5461, Caringo Is., 13°57′42″N., 123°06′42″E., 11 fm., June 14, 1909, *Alb.*, 1 ovig. female; Sta. 5594, near Mount Putri, 4°14′20″N., 117°53′12″E., 11 fm., Sept. 30, 1909, *Alb.*, 1 *Sacculina* infected male, 1 ovig. female; Sandakan Harbor, British North Borneo, June 28, 1929, Herre collection, 1 female.

Japan: Shimbara Gulf, Imperial University, Tokyo, 6 males, 3 females.

MEASUREMENTS.—Males, 24–41 mm.; females, 25–41 mm.; ovig. females, 27–36 mm.; juv., 20 mm.; *Sacculina* infected male, 37 mm.

REMARKS.—The third maxilliped shows slight iridescence on the last three segments of the endopodite and also on the forwardly directed portion of the fourth. This feature, presumably of some specific importance, has not been noted previously.

DISTRIBUTION.—Madagascar and East Africa to Japan, Philippines, and Australia.

The *Portunus longispinosus* Complex

Crosnier (1962) has suggested that two and possibly three different species have been given the name *longispinosus* by Rathbun (1906), by Sakai (1939), and by Stephenson and Campbell (1959), respectively. He also notes that *Amphitrite vigilans* Dana 1852, which has been synonymized with *A. longispinosa* Dana 1852, is probably a distinct species and is possibly identical with his own *P. iranjae*. In the opinion of the present authors, it will prove impossible to relate specimens to one or another of Dana's species unless the types can be discovered. The differences in anterolateral teeth lie within the range of a single species, and neither of Dana's figures of carapace ornamentation conform exactly to those of known species.

Apart from the above species (i.e., *P. longispinosa* (Dana), *P. vigilans* (Dana), and *P. iranjae* Crosnier, the remaining closely

related species are: *P. macrophthalmus* Rathbun 1906, *P. longispinosus bidens* Laurie 1906, *P. emarginatus* Stephenson and Campbell, 1959, and *P. tenuicaudatus* Stephenson, 1961a.

Disregarding synonymy problems, most of the undamaged males in the present collection could be referred to one or another of the above species without great difficulty. Problems arose over two dissimilar sized males (10 mm. and 20 mm. carapace breadths) from the same collection (Palau, Sta. 124–1183). Although undoubtedly belonging to the same species, they differed in certain features which have been relied upon heavily in past descriptions, viz the length and acuteness of the lateral frontal teeth, and the proportions and shapes of the ultimate and penultimate segments of the male abdomen. In the smaller specimen the frontal teeth are low and rounded (cf. *P. emarginatus*); the male abdomen is short and broad, with only slightly concave outer borders of the penultimate segment and with an ultimate segment as long as broad (cf. *P. longispinosus* Stephenson and Campbell). In the larger specimen the frontal teeth, while low and rounded, project farther (as in *P. longispinosus* Stephenson and Campbell), and the male abdomen, although moderately long and with distinctly concave borders to the penultimate segment (as in *P. emarginatus*), has the ultimate segment slightly longer than broad.

P. longispinosus Stephenson and Campbell and *P. emarginatus* show many points of similarity, including an absence of tuberculate elevations upon the granulated areas of the carapace and quite similar pleopods. Tentatively they are treated as synonyms, and specimens are listed under *P. emarginatus*.

While, as indicated, frontal teeth and male abdomens may have less diagnostic importance than previously thought, they still have some value. It is believed, however, that the details of ornamentation of the dorsal surface of the carapace offer the best opportunities for separating the species, although here again there is variation.

In the mesobranchial areas of the carapace both of the present specimens of *P. iranjae* bear elevated tubercular projections that were not present in the specimens submitted by Crosnier to the senior author. Stephenson's comments are quoted in Crosnier's description.

Recently Described Species in *P. longispinosus* Complex

1. Upper surface of palm of chelipeds with a single distal spine.
P. longispinosus bidens (Laurie) 1906
Upper surface of palm of cheliped with two distal spines or with a spine and a spiniform tubercle 2
2 (1) Outer frontal teeth low and rounded (granular eminences of carapace without tubercles).
P. emarginatus Stephenson and Campbell, 1959
Outer frontal teeth triangular, projecting, and typically sharp . . . 3

3. (2) Cheliped very long and slender, 2½ times the carapace length.
P. longispinosus Sakai, 1939
Chelipeds of moderate length and robustness, less then 2½ times the carapace length 4
4. (3) Carapace with conspicuous tubercular elevations within the granular patches 5
Carapace (apparently) without conspicuous tubercular elevations within the granular patches . . . . . **P. longispinosus** Rathbun, 1906
5. (4) Carapace strongly embossed, with spiniform elevations in cardiac and mesobranchial areas (lateral postcardiacs distinct and separate).
P. tenuicaudatus Stephenson, 1961a
Carapace moderately strongly embossed with tuberculate but not spiniform elevations in the cardiac and mesobranchial areas . . . 6
6. (5) Metagastric area with two tubercles, lateral postcardiac granular patch not distinctly recognizable . . . **P. macrophthalmus** Rathbun, 1906
Metagastric area with short ridges but without tubercles, lateral postcardiac granular patch distinct and separate.
P. iranjae Crosnier, 1962

Portunus emarginatus Stephenson and Campbell

Portunus emarginatus Stephenson and Campbell, 1959, pp. 107–108, figs. 2H, 3H, pls. 2 (fig. 4), 4H, 5H.—Crosnier, 1962, pp. 66–68, figs. 108, 112–114, 116, 120–121.

?*Portunus longispinosus* Rathbun.—Stephenson and Campbell, 1959, pp. 104–106, figs. 2F, 3F, pls. 2 (fig. 2), 4F, 5F.

MATERIAL.—Palau: Sta. 124-1183, Yos Passage, W. of Kasao Reef, 3¼ mi. SSE. of Ngaremdiu, E. of Urukthapel, sand, 15–18 fm., Aug. 24, 1955, 2 males (10, 20 mm.).

Portunus iranjae Crosnier

Portunus iranjae Crosnier, 1962, pp. 61–65, figs. 107, 110–111, 115, 118–119, pl. 4 (fig. 2).

MATERIAL.—Philippines: Reef at Tileg, Lubang I., July 11, 1908, Paul Bartsch, *Alb.*, 1 male (19 mm.).

Tuamotus and Societies: Papetoai Bay, Moorea, poison sta. shore reef, 3–20 ft., Apr. 30, 1957, J. Randall, 1 male (23 mm.).

Portunus macrophthalmus Rathbun

Portunus macrophthalmus Rathbun, 1906, p. 871, fig. 31, pl. 12 (fig. 15).

MATERIAL.—Philippines: Sta. 5218, Anima Solo I., between Burias and Luzon, 20 fm., Apr. 22, 1908, *Alb.*, 1 ovig. female (11.5 mm.).

REMARKS.—In comparison with the various species examined by the authors, the present specimen comes closest to *P. tenuicaudatus* but differs in having more protruding and sharper lateral frontal teeth, these being distinctly acute; in having the carapace less strongly embossed, this applying particularly to the cardiac eminences and the lateral postcardiacs, which are only indistinctly recognizable; in possessing two small tubercular eminences instead of rows of gran-

ules in the metagastric region; and in having longer and more slender chelipeds.

These four points of difference seem to be confirmed by examination of Rathbun's plate 12, figure 5.

Portunus tenuicaudatus Stephenson

Portunus tenuicaudatus Stephenson, 1961a, pp. 114–116, figs. 2C, 3H, pls. 3 (fig. 2), 4H, 5C.

MATERIAL.—Philippines: Sta. 5160, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′40″N., 119°55′10″E., 12 fm., sand, Feb. 22, 1908, *Alb.*, 1 male (14 mm.).

REMARKS.—This species is very close to *P. longispinosus bidens* (Laurie) as described and figured by Sakai. Both species have spiniform tubercles on the dorsal surface of the carapace, and many of them are identically situated. (These are not mentioned by Laurie, 1906.) However, *P. tenuicaudatus* lacks the tubercles of the posterior mesobranchial regions described by Sakai, and in the holotype (but not in the present specimen) there is a tubercle in each median postcardiac region. The median frontal teeth in *P. longispinosus bidens* appear much larger than those in *P. tenuicaudatus*. It also possesses a spiniform tubercle at the end of the central carina of the upper surface of the hand which has no described counterpart in *P. longispinosus bidens*. There is marked similarity but not absolute identity in the pigmentation of recently collected specimens.

Portunus Species

MATERIAL.—Marshalls: 4707, Rongelap Lagoon, 2 mi. W. of Busch I., 20 fm.; June 21, 1946, Taylor, 1 male (18 mm.).

REMARKS.—This specimen lacks the ultimate and penultimate segments of the abdomen and is either *P. longispinosus* Rathbun or *P. longispinosus* Sakai. Its chelipeds, although long and slender, are less so than Sakai described.

Portunus Species

MATERIAL.—Marshalls: EL–160, Arno Atol, received 1952, Hiatt, 1 damaged male (10 mm.).

REMARKS.—This specimen cannot be identified with certainty because the dorsal surface of the carapace, which bears tuberculate elevations on some of its granular patches, is damaged.

Portunus orbitosinus Rathbun

FIGURE 6

Portunus (*Amphitrite*) *gladiator* de Haan, 1837, only p. 65, pl. 18 (fig. 1) (not *Portunus gladiator* Fabricius, 1798).

Portunus (*Achelous*) *orbitosinus* Rathbun, 1911, p. 205, pl. 15 (fig. 11).

Neptunus (*Achelous*) *orbitosinus* (Rathbun).—Gordon, 1938, pp. 182–185, figs. 5a–g, 6c, 6d (including *N. octodentata*).

Neptunus (*Achelous*) *orbitospinus* (Rathbun).—Sakai, 1939, p. 396, pl. 81 (fig. 2).

Portunus orbitosinus Rathbun.—Stephenson and Campbell, 1959, pp. 113–114, figs. 2L, 3L, pls. 3 (fig. 4), 4L, 5L.—Stephenson, 1961a, pp. 108–109.—Crosnier, 1962, pp. 55–57, figs. 88, 90–91, 93.—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

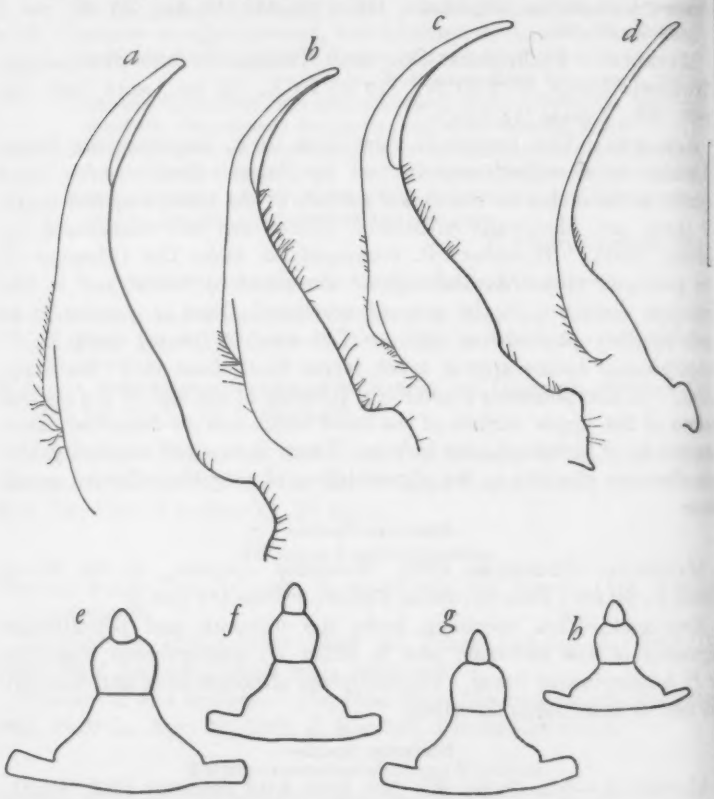

FIGURE 6.—*Portunus orbitosinus* Rathbun, male pleopods and abdomens, respectively. Three variants of form A: *a* and *e*, Philippines, Mariveles, No. 27, Reese; *b* and *f*, Philippines, Sta. 5158, *Alb.*; *c* and *g*, same as *a* and *e*. Form B: *d* and *h*, Philippines, Labuan Blanda I., *Alb.* (Scales=*a–d*, 1 mm.; *e–h*, 5 mm.)

MATERIAL.—Two forms are recognized in adult males, called forms A and B, respectively. These are listed separately as are females.

MALES (FORM A)

Philippines: Subig Bay, China Sea off southern Luzon, shore,

seine, sand, Jan. 7, 1908, *Alb.*, 2 males; Alongapo, Luzon, shore, Jan. 7, 1908, *Alb.*, 1 male; Port Binanga, ship's side, 6 fm., Jan. 8, 1908, *Alb.*, 2 males; Sta. 5158, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′N., 119°54′30″E., 12 fm., Feb. 21, 1908, *Alb.*, 1 male; Sta. 5169, Sibutu Is., 4°32′15″N., 119°22′45″E., 10 fm., Feb. 27, 1908, *Alb.*, 1 male; Guijulugan, Negros, sta. shore, sand, gravel, mud, Apr. 2, 1908, *Alb.*, 1 male; Capurmypugan Point, Mindanao, 150 ft. seine, May 9, 1908, *Alb.*, 1 male; Point Jarnelo, Luzon, 150 ft. seine, July 13, 1908, *Alb.*, 1 male; Hinunangan Beach, Leyte, seine, July 30, 1909, *Alb.*, 1 male; No. 27, Mariveles, Luzon, June 27, 1913, A. M. Reese, 6 males; no. 33, other data as last, 13 males; near Mariveles, Luzon, 1913, A. M. Reese, 2 males; Cebu, 1929, *Eclipse* Exped., 2 males.

MALES (FORM B)

Philippines: Labuan Blanda I., Buton Strait, marginal coral, Dec. 13, 1909, *Alb.*, 2 males.

FEMALES

Philippines: Subig Bay, China Sea, off southern Luzon, shore seine, sand, Jan. 7, 1908, *Alb.*, 2 ovig. females; Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 1 ovig. female; Labuan Blanda I., Buton Strait, marginal coral, Dec. 13, 1909, *Alb.*, 1 female; no. 27, Mariveles, Luzon, June 27, 1913, A. M. Reese, 3 ovig. females; no. 33, other data as last, 3 females, 1 ovig. female; near Mariveles, Luzon, 1913, A. M. Reese, 1 female, 3 ovig. females.

Marshalls: Sta. VI, Bikini I., outer reef, Aug. 5, 1947, F. M. Bayer, 1 female.

MEASUREMENTS.—Males form A, 11–26 mm.; males form B, 12, 13 mm.; females, 17–24 mm., ovig. females, 13–21 mm.

REMARKS.—Gordon (1938, pp. 179–185, figs. 4 and 5) discussed *Neptunus orbitosinus* and particularly an unusual specimen with eight instead of nine anterolateral teeth and with a more robust male pleopod than in one of Rathbun's cotypes. Stephenson and Campbell (1959, p. 144) supported Gordon's suggestion that she was dealing with an undescribed species (*Neptunus octodentata*) and stated: "It is inconceivable that the variation in pleopod structure within *P. orbitosinus* could encompass the structures she figures (figs. 4*c*, 4*c*[1])."

Actually Gordon figured the pleopod of a further variant of a "male near to *orbitosinus* from Admiralty Is. ('Challenger' Colln.)," which was distinctly longer and thinner than any of the remainder.

In the present collection, there is a very considerable variation in pleopod structure between males which are indistinguishable in

general facies. Four main variants were noted and are figured (fig. 6). In the first, the pleopod is short and stout, little curved and naked on the center of its outer surface. In the second, the appendage is relatively thinner, more curved, and with hairs in the center of its outer surface. In the third, the appendage is even more curved but otherwise resembles the second form. In the fourth, the appendage is very long and slender, slightly curved, and resembles Gordon's specimen from the "Challenger" collection.

The first three variants show a certain amount of intergrading and are concluded to belong to the same morphological entity, whether a species, subspecies, or "form." What Stephenson and Campbell considered "inconceivable variation" apparently occurs. On the other hand, there seems to be a distinct hiatus between these and the fourth variant. Following the pattern established for *P. argentatus*, the first three variants are designated form A and the fourth, form B.

Crosnier (1962) figured a male pleopod of *P. orbitosinus* from Madagascar, greatly resembling figure 6 (c). Most of the present specimens differ from Crosnier's in having a larger first anterolateral tooth well separated from the second tooth. All differ in having smaller ninth teeth pointing less directly outward.

DISTRIBUTION.—Seychelles to Japan, and Australia.

***Portunus pelagicus* (Linnaeus)**

FIGURES 12*c*,*d*, 17*b*

Cancer pelagicus Linnaeus, 1766, p. 1042.

Neptunus pelagicus (Linnaeus).—Alcock, 1899, p. 34.—Sakai, 1939, pp. 387–388, pl. 49.

Lupa pelagica (Linnaeus).—Barnard, 1950, pp. 152, 153–154, fig. 27.

Portunus pelagicus (L.).—Stephenson and Campbell, 1959, pp. 96–98, figs. 2A, 3A, pls. 1 (fig. 1), 4A, 5A.—Sankarankutty, 1961a, pp. 103–104.—Crosnier, 1962, pp. 43–44, figs. 58, 61, 67.—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only). Dell, 1964a, pp. 303–304, 2 figs.

MATERIAL.—Malay Archipelago: Tachalorn, Siam, July 24, 1923, H. M. Smith, 1 male; Bangkok, Siam, July 24, 1923, H. M. Smith, 1 female; off Paknam, Gulf of Siam, Sept. 8, 1923, 1 female; Gulf of Siam, Lang Suen, Sept. 17, 1923, H. M. Smith, 1 female; Bandon Bight, Siam, September 1923, H. M. Smith, 1 male, 1 ovig. female; Chantabun River, at Lem Sing, Siam, May 7, 1927, H. M. Smith, 1 female; Singapore, Mar. 14, 1934, Herre, 1 female; Sta. 1004, purchased from Thailand, received Aug. 24, 1955, R. E. Elbel, 2 males, 1 female; Sta. 27, east coast of Gulf of Thailand, S. of Trat Bay off Lam Son Village, near Cambodian border, 11°57′00″N., 102°44′45″E., 10 m., shrimp trawl, Oct. 29, 1957, GVF, 1 male; Thailand, Songkhla, channel between Songkhala City and Goh Gnu I., Nov. 3, 1957, GVF, 1 female.

China: U.S. Nav. Med. Res. Unit 2, Taipei, Formosa, purchased, received Feb. 13, 1958, Kuntz, 1 female.

Philippines: Grande I., Subic Bay, Luzon, October 1907, Dr. J. C. Thompson, 1 ovig. female; Manila Bay, Dec. 9, 1907, *Alb.*, 1 male; Manila Harbor, Dec. 30, 1907, *Alb.*, 1 female; Sta. 5346, Cliff I., Malampaya Sound, Palawan Is., 10°50′30″N., 119°22′20″E., 7 fm., Dec. 26, 1908, *Alb.*, 1 female; Iloilo, Mar. 24, 1929, H. C. Kellers, 2 males; Iloilo, May 5, 1929, H. C. Kellers, 1 male, 1 female; Sandakan Harbor, British North Borneo, June 28, 1929, Herre, 1 male, 2 females; Manila Bay, Dec. 22, 1933, Herre collection, 1 male.

Australia: Lake Macquarie, N.S.W., M. Filmer, Henry J. Brown, 1 male; Umba Kumba, south side of Little Lagoon, northeast end of Groote Eylandt, Gulf of Carpentaria, between Apr. 6 and May 18, 1948, R. R. Miller, 2 males, 1 female, 3 juvs.; Little Lagoon, northeast end of Groote Eylandt, Gulf of Carpentaria, 1948, R. R. Miller, 8 juvs.

MEASUREMENTS.—Males, 26–129 mm.; females, 38–125 mm.; ovig. females, 108–118 mm., juvs. 13–40 mm.

DISTRIBUTION.—East Africa to Tahiti, including Japan, Philippines, Australia, and New Zealand.

***Portunus pubescens* (Dana)**

Lupa pubescens Dana, 1852a, pp. 274–275, pl. 16 (fig. 9); 1852b, p. 84.
Portunus pubescens (Dana).—Rathbun, 1906, p. 870, pl. 14 (fig 1).—Edmondson, 1954, pp. 237–238, figs. 12, 13.—Stephenson and Campbell, 1959, pp. 99–101, figs. 2c, 3c, pls. 1 (fig. 3), 4C, 5C.—Stephenson, 1961a, p. 111.
Neptunus pubescens (Dana).—Sakai, 1934, p. 303; 1939, pp. 388–389, pl. 80 (fig. 1).

MATERIAL.—China: AT–51, Namru-2-Taipei, Formosa, 12 mi. S. of Tau Hsui, seashore, Lighthouse Beach, 1957, R. E. Kuntz, 1 male (19 mm.).

Philippines: Port San Pio, in small stream near mouth, 20 ft. seine, Nov. 11, 1908, *Alb.*, 1 female (17 mm.).

REMARKS.—Crosnier (1962) in redescribing *P. convexus* de Haan has drawn attention to its close similarity to *P. pubescens;* however, male *P. convexus* are easily distinguished by their sinuous pleopods (Crosnier, 1962, figs. 64–66).

DISTRIBUTION.—Eastern and Western Australia, Japan, and Hawaii.

***Portunus pulchricristatus* (Gordon)**

FIGURE 7

Neptunus (*Hellenus*) *spinipes* Alcock, 1899, pp. 31–32, 39–40.
Neptunus (*Hellenus*) *pulchricristatus* Gordon, 1931, p. 534, figs. 8, 10a.
Not *Neptunus* (*Amphitrite*) *spinipes* Miers, 1886, p. 178, pl. 15 (fig. 1).

MATERIAL.—Philippines: Sta. 5097, Corregidor Lt., China Sea, off southern Luzon, 14°19′15″N., 120°33′52″E., 30 fm., Jan. 2, 1908,

Alb., 1 female; Sta. 5100, Corregidor Lt., China Sea, off southern Luzon, 14°17′15″N., 120°32′40″E., 35 fm., Jan. 2, 1908, *Alb.*, 1 male; Sta. 5104, China Sea, off southern Luzon, 14°45′48″N., 120°12′20″E., Jan. 8, 1908, *Alb.*, 5 males, 1 female, 2 ovig. females, 2 juvs., 1 *Sacculina* infected female, 1 *Sacculina* infected unsexable specimen; Sta. 5105, Suesti Point Light, China Sea, 25 fm., 14°43′55″N., 120°12′50″E., Jan. 8, 1908, *Alb.*, 1 male, 3 females, 1 juv., 1 unsexable *Sacculina* infected specimen; Sta. 5181, Antonia Is., eastern Panay, 11°36′40″N., 123°26′35″E., 26 fm., Mar. 27, 1908, *Alb.*, 1 ovig. female; Sta. 5192, off North Cebu Is., Jilantaguan Is., 11°09′15″N., 123°50′E., 32 fm., Apr. 3, 1908, *Alb.*, 1 male; Sta. 5207, Badian Is., off western Samar, 11°38′05″N., 124°40′45″E., 35 fm., green mud, sand, Apr. 14, 1908, *Alb.*, 1 male, 1 female; Utara Point, Bongo I., 7°21′N., 124°07′E., May 22, 1908, *Alb.*, 2 females; Sta. 5342, Endeavour Point (S.), 10°56′55″N., 119°17′24″E., 12–25

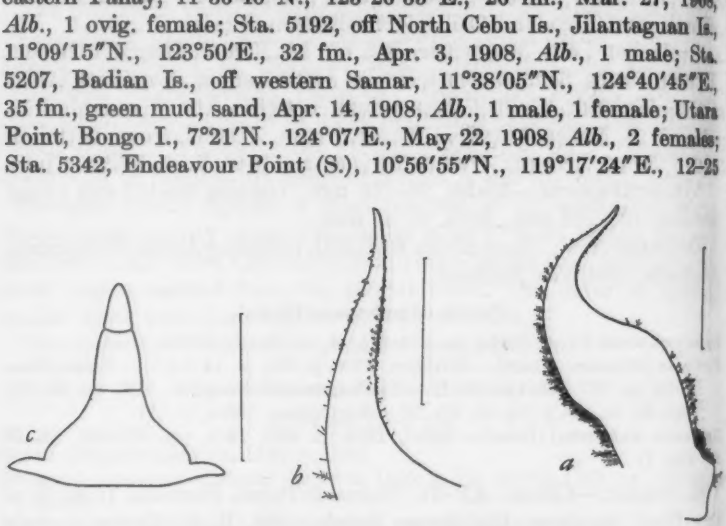

FIGURE 7.—*Portunus pulchricristatus* (Gordon), male, Philippines, Sta. 5100, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.5 mm.; *c*, 5 mm.)

fm., Dec. 23, 1908, *Alb.*, 5 males, 1 female, 1 ovig. female; Sta. 5442, west coast of Luzon, South Fernando Point Lt., 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 16 males; Sta. 5448, South Miguel Point, east coast Luzon, 13°23′10″N., 123°45′19″E., 47 fm.; June 4, 1909, *Alb.*, 3 males; Sta. 5644, Makassar I., Buton Strait, 5°27′24″S., 122°38′00″E., 22 fm.; Dec. 16, 1909, *Alb.*, 1 male; Sta. 5646, North I., Buton Strait, 5°31′30″S., 122°22′40″E., 456 fm., green mud, Dec. 16, 1909, *Alb.*, 1 male.

China: All from China Sea, vicinity Hong Kong, *Alb.*, 1908. Sta. 5302, 21°42′N., 114°50′E., 38 fm., Aug. 9, 4 males, 4 females, 1 ovig. female; Sta. 5303, 21°46′N., 114°47′E., 34 fm., black mud, Aug. 9, 5 males, 2 females; Sta. 5304, 21°46′N., 114°47′E., 34 fm., black mud, Aug. 9, 4 males, 3 females, 1 ovig. female; Sta. 5305, 21°54′N.,

114°46′E., 37 fm., Oct. 24, 2 males; Sta. 5308, 21°54′N., 115°42′E., 62 fm., Nov. 4, 1 male.

MEASUREMENTS.—Males, 15–29 mm., females, 14–23 mm., ovig. females, 16–22 mm., juvs. 6–10 mm., *Sacculina* infected specimens, 14–18 mm.

REMARKS.—In addition to the distinctions between this species and *P. spinipes* as listed by Gordon, it lacks the very fine tapering point on the male pleopod (compare figs. 7*c* and 14*c*).

DISTRIBUTION.—Madras, Andamans, Gulf of Martaban, Arakan Coast, and Muscat.

Portunus rubromarginatus (Lanchester)

Achelous rubromarginatus Lanchester, 1900, pp. 746–747, pl. 46 (fig. 8).
Neptunus (*Amphitrite*) *rubromarginatus* (Lanchester).—Shen, 1937, p. 104.
Portunus rubromarginatus (Lanchester).—Stephenson and Campbell, 1959, pp. 112–113, figs. 2K, 3K, pls. 3 (fig. 3), 4K, 5K.

MATERIAL.—Philippines: Jolo, ship's side, electric light, 14 fm., Feb. 8, 1908, *Alb.*, 1 female; Jolo anchorage, electric light, Mar. 5, 1908, *Alb.*, 1 female; Sta. 5561, Tutu Bay (Jolo), coral and sand, Sept. 19, 1909, *Alb.*, 3 males, 1 female; Labuan Blanda I., Buton Strait, marginal coral, Dec. 13, 1909, *Alb.*, 1 female.

MEASUREMENTS.—Males, 11–16 mm.; females, 16–29 mm.

REMARKS.—The anteroexternal angle of the merus of the third maxillipeds is produced laterally but not strongly so (see Stephenson and Campbell, 1959, pl. 5K). This leads to uncertainty in the key (above authors p. 90, couplet 16). The species is possibly closest to *P. curvipenis* Stephenson (1961a, pp. 106–108, figs. 1G, 3E; pl. 2, fig. 3; pls. 4E, 5B).

DISTRIBUTION.—Malay Archipelago, Hong Kong, South China Sea, and Australia.

Portunus cf. *rubromarginatus*

PLATE 3A

MATERIAL.—Japan: Sta. 5081, off Omai Saki, 35°14′N., 138°05′E., surface, Oct. 19, 1906, *Alb.*, 1 incomplete female (13 mm.).

REMARKS.—Only the carapace and two chelae are present. The differences compared with typical *P. rubromarginatus* are more spiniform frontal teeth (pl. 3A), more rounded granular eminences in the cardiac region of the carapace, more spiniform first eight anterolateral teeth, and longer ninth tooth.

Portunus rugosus (A. Milne Edwards)

FIGURES 8–11; PLATES 3B, 4, 5

Neptunus rugosus A. Milne Edwards, 1861, p. 335, pl. 33 (fig. 3).—Hess, 1865, p. 139.—A. Milne Edwards, 1873, pp. 156–157.—Miers, 1886, pp. 176–177

(partim).—de Man, 1887, pp. 70–73 (under *N. andersoni*).—Henderson, 1893, p. 369 (under *N. andersoni*).

Portunus rugosus (A. Milne Edwards).—Guinot, 1957, p. 480 (under *P. marisi*).—Stephenson, 1961a, pp. 111–114, figs. 2B, 3G, pls. 3 (fig. 1), 4G, 5E.

INTRODUCTION.—Original sorting of specimens gave seven different forms resembling *P. rugosus*. Differences between them concerned shape of frontal teeth, length of last anterolateral tooth, acuteness or otherwise of posterior-posterolateral junction of the carapace, occurrence of a paried or single metagastric granular elevation of the carapace, curvature and spinulation of the pleopod, and relative length of penultimate segment of male abdomen. Later it was shown that some of these features varied with size of specimens within a single collection (e.g., length of last anterolateral tooth), while others varied between adjacent collections (e.g., acuteness or roundedness of frontal teeth). To separate most of the remaining

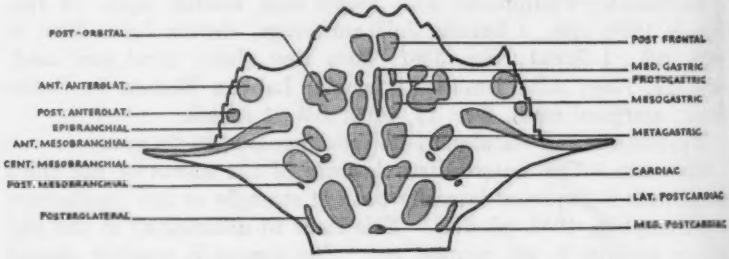

FIGURE 8.—*Portunus rugosus* (A. Milne Edwards): Diagram of elevated granular areas of carapace.

forms involved reliance upon a single character (e.g., paired or single metagastric elevation), and it was concluded that two forms, here designated I and II, were present.

These were compared with the Western Australian material upon which Stephenson's (1961a) redescription of the species is based. This material belongs to form I.

The features common to all variants are listed below, followed by accounts of the variation within forms I and II and of the distinctions between them. These are followed by a brief report upon Milne Edwards' material.

MATERIAL.—Form I: Philippines: Jolo, ship's side, Feb. 8, 1908, *Alb.*, 1 female (dried); Jolo anchorage, electric light, Feb. 13, 1908, *Alb.*, 1 male; Sta. 5156, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′50″N., 119°55′55″E., Feb. 21, 1908, *Alb.*, 1 male; Sta. 5157, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°21′30″N., 119°55′50″E., 18 fm., fine sand, Feb. 21, 1908, *Alb.*, 5 males, 3

females, 1 ovig. female, 1 juv; Sta. 5158, Tinakta I., Sulu Archipelago, Tawitawi, 5°12′N., 119°54′30″E., 12 fm., Feb. 21, 1908, *Alb.*, 1 juv; Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 1 male; Sta. 5182, Antonia I., eastern Panay, 11°30′40″N., 123°23′20″E., Mar. 27, 1908, *Alb.*, 1 juv.

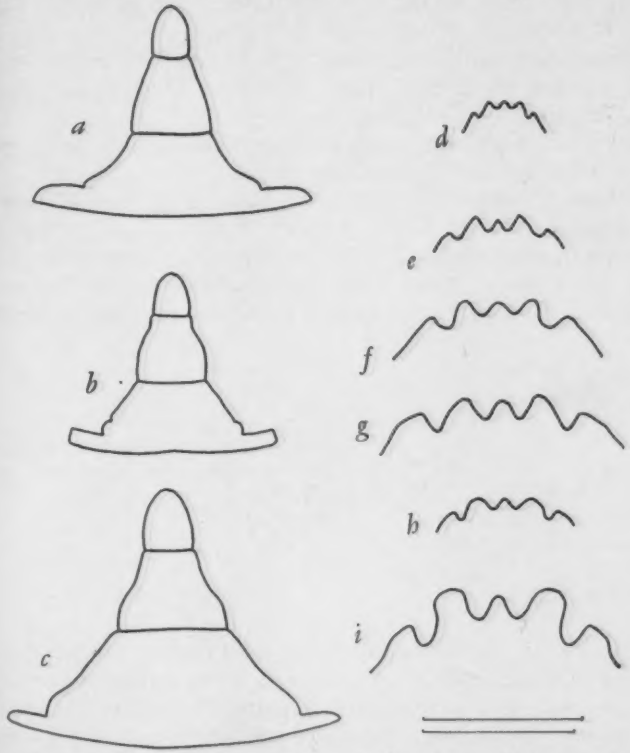

FIGURE 9.—*Portunus rugosus* (A. Milne Edwards). Male, abdomens, form I: *a*, Philippines, Sta. 5159, *Alb.*; *b*, W. Australian Mus. Reg. No. 47–60; form II: *c*, Philippines, Sta. 5159, *Alb.*, 30 mm. Fronts, form I: *d*, Philippines, Sta. 5158, *Alb.*, 8 mm. juv.; *e*, Philippines, Port Uson, *Alb.*, 16 mm. ovig. female; *f*, Philippines, Sta. 5159, *Alb.*; *g*, W. Australian Mus. Reg. No. 51–60; form II: *h*, Philippines, Sta. 5169, *Alb.*; *i*, Philippines, Sta. 5159. *Alb.*, 30 mm. male. (Scale=approximately 5 mm., 2 lines indicate range.)

male, 1 female, Cataingan Bay, Masbete, electric light, Apr. 19, 1908, *Alb.*, 1 juv.; Busin Harbor, Burias I., electric light, Apr. 22, 1908, *Alb.*, 2 males, 1 juv. female; Looc, Lubang I., electric light, July 18, 1908, *Alb.*, 1 female; Port Uson, W. of Pinas I., electric light, Dec. 17, 1908, *Alb.*, 1 ovig. female; Endeavour Strait, electric light, Dec. 23, 1908, *Alb.*, 2 juv. females.

Form II: Philippines: Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 2 males (ca. 21, 30 mm.), female (23 mm.), ovig. female (25 mm.); Sta. 5160, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′40″N., 119°55′10″E., 12 fm., sand, Feb. 22, 1908, *Alb.*, 2 females (17, 18 mm.); Sta. 5169, Sibutu I., 4°32′15″N., 119°22′45″E., 10 fm., Feb. 27, 1908, *Alb.*, 2 females (both 16 mm.).

MEASUREMENTS.—Form I: Males, 16–36 mm.; females, 15–38 mm.; ovig. females, 16, 32 mm., juvs. unsexed, 8–17 mm.; juv. male, 17 mm.; juv. females, 12–15 mm.

FEATURES IN COMMON.—Front: 3-toothed, middle tooth usually the smallest and least projecting.

Cheliped: Robust but elongate. Posterior border of arm with single spine, anterior border with three spines, distal being widely separate from remainder. Ventrodistal extremity of arm bearing boss with small spine. Hand with upper surface bearing two granular carinae of which only inner ends in a subterminal spine; outer surface

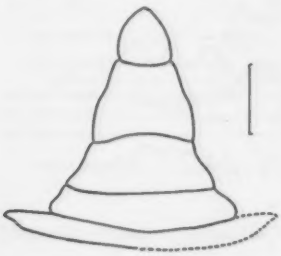

FIGURE 10.—*Portunus rugosus* (A. Milne Edwards): Male abdomen, New Caledonian specimen from Muséum National d'Histoire Naturelle. (Scale=1 mm.)

with two upper carinae clearly distinguishable and granular, but with lowermost merging into granulation of under surface; under surface with regular rows of granules giving a squamiform effect; inner surface with central row of carina of rounded granules (except in one juvenile).

Anteroexternal angle of merus of third maxilliped: Produced forward.

Ventral surface of thorax: Bearing conspicuous beaded granules.

Dorsal surface of carapace: With hairy pile, through which project conspicuously elevated granular regions. These are more numerous than those figured by Stephenson and Campbell (1959, fig. 1b), and a modified terminology is adopted as shown in figure 8. Additional granulated areas are a pair of postfrontals and pair of post orbitals typically divided into three indistinct subareas. Gastric region with distinct median gastric patch with protogastrics and mesogastrics on each side, and metagastric behind. Protogastrics small, and typically

indistinctly separate from mesogastrics, which themselves typically bear ridgelike anterior terminations. Metagastric area sometimes bears two granular areas separated in midline, and sometimes a single continuous area with central ridge or tubercle. Two conspicuous anterolateral patches, anterior being the larger. Three pairs of mesobranchials, the anterior often subdivided into larger anteroexternal and smaller posteromedian patch. Central mesobranchial either oval or rectangular; posterior either short line of granules or small tubercle formed of fused granules. Cardiacs conspicuously elevated, usually triangular, and with ridgelike or tubercle-like anterior termination. Lateral postcardiacs large and oval, median postcardiac small and with ridgelike or tuberculate anterior termination. Posterolaterals forming an arc.

Anterolateral teeth: Fourth and sixth the smallest, occasionally one or the other rudimentary or absent.

Posterodistal border of merus of fifth legs: Finely serrated.

VARYING FEATURES.—Features that vary within a form are described below under each form respectively.

FORM I

Frontal teeth: Median tooth usually shorter than laterals, but sometimes projecting forward slightly farther. Lateral teeth varying from acute to bluntly rounded.

Length of last anterolateral tooth: Varying within a collection depending on size of specimen, e.g., Sta. 5157 specimens less than 20 mm. carapace breadth with long tooth (equivalent in length to three or four preceding teeth), and specimens greater than 35 mm. breadth with short teeth (equivalent in length to one and a half preceding teeth). Also varying from collection to collection. Overall from lengths of one and a half to six preceding teeth.

Posterior-posterolateral junction of carapace: Sometimes distinctly acute, sometimes slightly more acute than a right angle, typically obtusely angled, sometimes obtusely rounded. Acuteness varies within a collection (acuter teeth in smaller specimens) and also between collections.

General granulated areas of carapace: Typically coarsely granular and conspicuously elevated. In some collections more finely granular and less conspicuous, in others more conspicuous and tending to form elevated tubercles.

Male abdomen: Length of penultimate segment varying from slightly longer than broad to conspicuously so. Length of ultimate segment also varying.

Male pleopod: Varying in curvature with size of specimen being slightly curved in small and conspicuously curved in larger specimens. Subterminal bristles on inside varying from zero to nine. Subterminal bristles on center of under surface varying from sparse to dense.

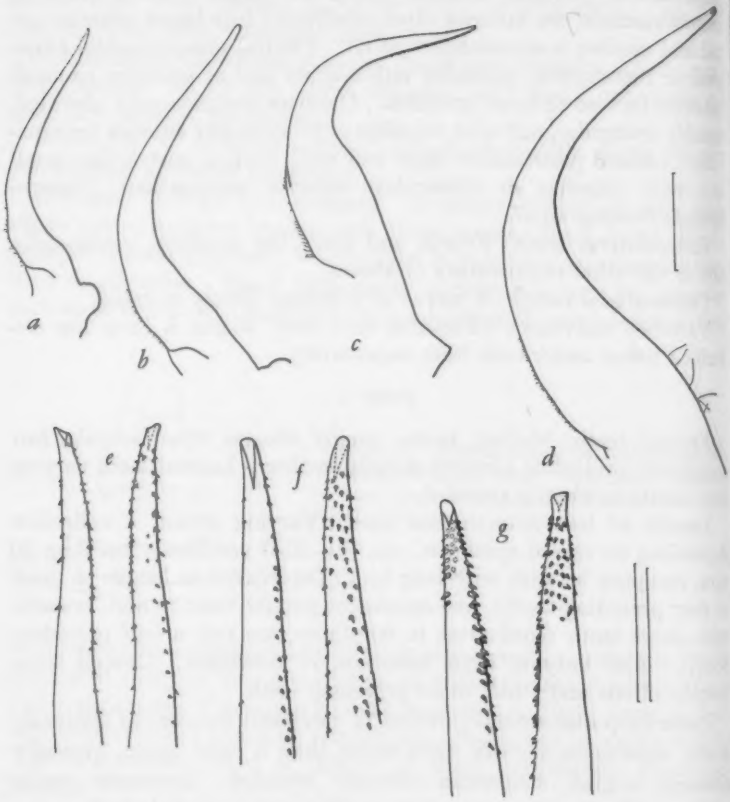

FIGURE 11.—*Portunus rugosus* (A. Milne Edwards), male pleopods and pleopod tips, respectively. Form I: *a* and *e*, Philippines, Sta. 5159, *Alb.*; *b* and *f*, W. Australian Mus. Reg. No. 51–60; *d*, Philippines, Sta. 5157, *Alb.*, largest male. Form II: *c* and *g*, Philippines, Sta. 5159, *Alb.* (Scales=*a–d*, 1 mm.; *e-g*, approximately 0.5 mm., 2 lines indicate range.)

The most conspicuous variation is the presence of a single metagastric elevated area instead of two, as shown by the following: Endeavour Strait, 2 specimens; Looc, 1 specimen.

One specimen (Port Uson, Dec. 17, 1908) possesses acute frontal teeth and conspicuously elevated central mesobranchial areas. Be-

cause it is distinctly small for an ovigerous female (16 mm.), it is possible it should be separated from the remainder.

FORM II

Only eight specimens from three stations are available, but even so variation between them is less than might be expected from a study of form I. In smaller specimens the lateral frontal teeth are relatively shorter, less projecting, and less outwardly inclined. In two specimens (Sta. 5169) there is a single instead of a pair of metagastric granulated elevations.

Unexpectedly constant features in form II comprise:

a. Anterolateral teeth always long, equivalent in length to about five of the preceding teeth.

b. Posterior-posterolateral junction of carapace always near to a right angle and moderately sharp.

c. General granulated areas of carapace relatively inconspicuous amongst the pile of hairs, not very coarsely granular, and without any tendency to be tuberculate.

MILNE EDWARDS' MATERIAL.—Through the good offices of Mme. Danièle Guinot, the following specimens were received from the Muséum National d'Historie Naturelle, Paris: 1 male (ca. 14 mm.), 1 ?female, labelled "*Neptunus rugosus* A. M. Edw. Auct. det. Coll. A. Milne Edwards 1903 (Marie) Nouvelle-Calédonie—Iles des Pins, 1873, p. 156. Ancienne collection sèche. D. Guinot 1963." Unfortunately, when received they were so damaged that the central portions of the carapace could not be studied, and one specimen could not be measured at all accurately. Remaining details are:

Frontal teeth: Acutely rounded, median almost as long as laterals. Similar to those of form I.

Last anterolateral tooth: Length equivalent to a little more than three preceding teeth, sinuous, and directed slightly backward. Similar to those of form I in length and form II in shape.

Carapace granulation: On undamaged areas, granulation much coarser than form II. Visible areas conspicuously elevated, as in form I.

Male abdomen: Ultimate segment as broad as long with rounded tip. Penultimate segment broader than long (breadth 1.37 times length), with sinuous convex sides. (See fig. 10.)

In general, these specimens are closest to form I, except for the shapes of both ultimate and penultimate segments of the male abdomen, which are closer to form II.

They bridge some of the gap between the two forms, and further collecting may result in a complete bridging. Meanwhile it is retained to emphasize the variability of the species.

DIFFERING FEATURES.—Features serving to distinguish between the two forms are tabulated as follows:

	lateral frontal teeth	*last anterolateral teeth*	*granulated areas of carapace*	*male abdomen*	*male pleopod, under surface*
Form I	Directed forward or inward but never outward; tips acute or bluntly rounded	Relatively straight	Conspicuous, coarsely granular, sometimes tuberculate	Penultimate segment either slightly or distinctly longer than broad	Row of spinules extending a long way back from the tip
Form II	Directed outward; tips rectangularly rounded	Slightly curved or sinuous; slightly backwardly directed	Relatively inconspicuous and less coarsely granular, not tuberculate	Penultimate segment as broad as long	Row of spinules only extending a short distance back from the tip

These features are not thought sufficiently weighty to merit specific separation for the following reasons:

a. One of the smaller specimens of form II (Sta. 5169) (fig. 9*h*) has frontal teeth intermediate between those typical of this form (see fig. 9*i*) and a specimen of form I from Western Australia (see fig. 9*g*).

b. The proportions of the penultimate segment of the male abdomen vary in form I, and little extension of the range would encompass form II.

c. There are insufficient mature males of form II (only two) to establish that minor differences between the very similar pleopods in the two forms are not due to variability.

d. Milne Edwards' original description included some features of form I and some of form II, and seems to bridge most of the gap between them. Partial examination of his damaged specimens tends to confirm this bridging. The features of form I, including one or another of its variants, are: "Carapace très-fortement bosselée" and "Angles postérieurs de la carapace aigus et spiniformes." The features of form II are first, "Cornes laterales très-grandes, très minces et légèrement dirigées en arrière," and second, obtuse lateral frontal teeth.

It should be noted that Milne Edwards' figures (pl. 33, figs. 3, 3a) show differences from both forms as follows:

a. The posterior anterolateral granulated patch is shown as almost the same size as the anterior.

b. The postorbital patch is shown more discretely than in any of the present specimens.

***Portunus sanguinolentus* (Herbst)**

FIGURES 12*a*, *b*

Cancer sanguinolentus Herbst, 1783, p. 161, pl. 8 (figs. 56, 57).

Portunus sanguinolentus (Herbst).—Rathbun, 1906, p. 870.—Edmondson, 1954, pp. 236–237, figs. 12, 13.—Stephenson and Campbell, 1959, pp. 98–99, figs. 2B, 3B, pls. 1 (fig. 2), 4B, 5B.—Sankarankutty, 1961a, p. 103.—Crosnier, 1962, pp. 45–47, figs. 59, 62–63, 68.—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

Neptunus sanguinolentus (Herbst).—Alcock, 1899, pp. 32–33.—Sakai, 1939, p. 387, pl. 48 (fig. 1).

Lupa sanguinolentus (Herbst).—Barnard, 1950, pp. 152, 154–155.

MATERIAL.—Malay Peninsula: Gulf of Siam, beach, North Singora, Oct. 5, 1923, H. M. Smith, 2 females; Benkoelen, Sumatra, November

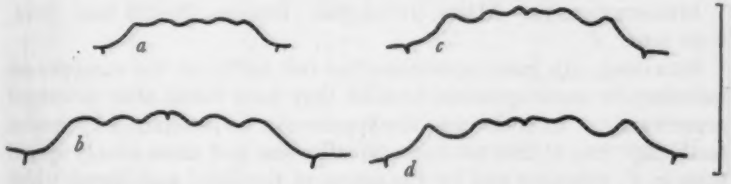

FIGURE 12.—Fronts. *Portunus sanguinolentus* (Herbst): *a*, Japan, Sta. 4920, *Alb.*, 19 mm. male; *b*, Malay Peninsula, Sta. 53, G.V.F., 35 mm. male. *P. pelagicus* (Linnaeus): *c*, Australia, Umba Kumba, Miller, 22 mm. male; *d*, same as *c*, 30 mm. male. (Scale=5 mm.)

1925, Kellers, 1 male; Sriracha, southeast Siam, Apr. 20, 1934, H. M. Smith, 1 juv; Thailand, Songkhla Channel between Songkhla City and Goh Gnu I., GVF Sta. 53, Nov. 3, 1957, 1 male; Thailand, Songkhla Channel next to city, Songkhla Province, purchased in fish market, 07°12′07″N., 100°37′15″E., GVF Sta. 44, Nov. 4, 1958, 5 males, 5 females, 1 juv. (damaged); Thailand, near rock jetty, S. of Chol Buri, between Bangsaen and Chol Buri, GVF Sta. 84, Dec. 1, 1957, R. Rofen, 1 female.

China: Kowloon, electric light, Sept. 14, 1908, *Alb.*, 1 juv.; AT–51, Namru-2-Taipei, Formosa, 12 mi. S. of Tau Hsui, seashore, Lighthouse Beach, 1957, R. E. Kuntz, 4 males, (2 damaged), 2 females, 2 juvs.

Philippines: Manila Bay, Dec. 7, 1907, *Alb.*, 1 female; Manila Bay, Dec. 8, 1907, *Alb.*, 1 female; San Vicente Port, Luzon Beach, Nov. 15, 1908, *Alb.*, 1 female; Linapacan I., Malcochin Harbor, electric light, Dec. 18, 1908, *Alb.*, 1 male; Nakochin Harbor, Linapacan I., seine, Dec. 19, 1908, *Alb.*, 1 female; near Sta. 5344, Malampaya, Palawan,

130 ft. seine, Dec. 26, 1908, *Alb.*, 1 male (dried); San Miguel Bay, Colssi Point, east coast of Luzon, June 14, 1909, *Alb.*, 1 juv; Sta. 5539, Apo I., between Negros and Siquijor, 9°03′20″N., 123°24′45″E., Aug. 19, 1909, *Alb.*, 1 juv; Philippine Is., E. A. Mearns, 2 males, 1 female; near Mariveles, Luzon, 1913, A. M. Reese, 1 female; Manila, Feb. 25, 1929, Kellers, 1 male; Iloilo, Apr. 20, 1929, H. C. Kellers, 2 males, 41 juvs., 2 damaged specimens; Iloilo, May 9, 1929, H. C. Kellers, 2 females; no. 363, Pandan, Antique, from trap at mouth of tidal stream, Apr. 7, 1946, D. G. Frey, 1 female.

Australia: M48–28, Port Bradshaw near Cape Arnhem, July 25, 1948, R. R. Miller, 1 female.

Marianas: 112–x–65, Ajayan River, Guam, June 19, 1945, D. H. Johnson, 1 female; Agfayan Bay, Guam, 145/R.H.B. 150, July 7, 1945, R. H. Baker, 1 male.

Japan: Sta. 4920, Kusakaki Jima, 30°34′N., 129°22′E., surface, Aug. 13, 1906, *Alb.*, 1 juv; Sta. 5081 off Omai Saki, 34°14′ N., 138°05′ E., surface, Oct. 19, 1906, *Alb.*, 6 juvs.

MEASUREMENTS.—Males, 21–43 mm.; females, 20–121 mm.; juvs., 9–20 mm.

REMARKS.—In many specimens the red marks on the carapace are indistinct or unrecognizable because they have faded after prolonged preservation. In such cases the species can be recognized by frontal teeth (figs. 12*a*, *b*) that are more equal in size and more evenly spaced than in *P. pelagicus* and by the merus of the third maxilliped, which is hairy as opposed to the smoothness in *P. pelagicus*.

Possibly *P. madagascariensis* (Hoffmann) is a synonym and based upon a faded specimen (see Crosnier, 1962, p. 47).[2]

DISTRIBUTION.—East Africa to Hawaii, including Japan and Australia and also from the Adriatic.

Portunus spiniferus, new species

FIGURE 13; PLATE 6A

MATERIAL.—Philippines: Varadero Bay, Mindanao, 10:30–11:30, electric light, July 22, 1908, *Alb.*, 1 male (23 mm., holotype, cat. no. 112094); Bolinao Bay, west coast of Luzon (on label, "Bohiao"), electric light, May 9, 1909, *Alb.*, 1 female (24 mm.); Batananan I., Dyn., June 13, 1909, *Alb.*, 1 female (28 mm.). Sta. 408, Dinagat, Surigao, light plankton, May 22, 1946, D. G. Frey, 1 male (30 mm.).

DESCRIPTION.—Front: 3-lobed, somewhat protruding. All lobes roundedly triangular, median about one-half size of laterals. Two conspicuous notches in upper border of orbit, lower border with stout, rounded tooth.

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[2] Later studies indicate it belongs to *Callinectes*.

Anterolateral teeth: Nine, first stout, fourth and sixth quite small, eighth larger than ninth, ninth the longest, stoutest, and very projecting.

Carapace: Much broader than long (ca. 2.2 times), with posterior-posterolateral junction forming an acute upturned spine, covered throughout by very fine, dense pubescence, through which small conspicuously raised granular areas are evident, several of these being spiniform. Beneath hairs, most of carapace smooth and shining. (Granulated areas showing through pile correspond with

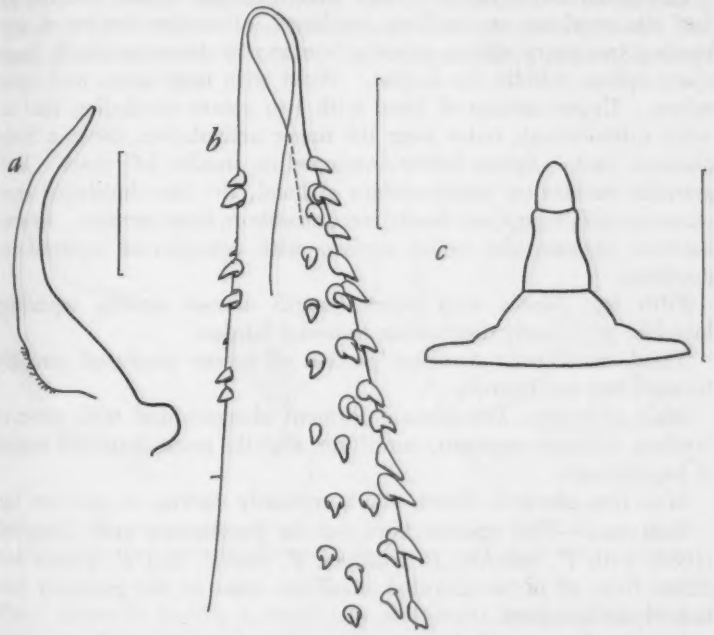

FIGURE 13.—*Portunus spiniferus*, new species, male holotype: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.1 mm.; *c*, 5 mm.)

those in *Portunus rugosus* complex and the terminology of figure 8 is employed.) Postfrontals relatively inconspicuous; median gastric elongate; protogastrics small and inconspicuous; mesogastrics terminated anteriorly by tubercle-like elevation; metagastrics each a small tubercle; postorbitals each composed of four reasonably distinct patches, the two posterior patches with ridgelike anterior terminations; anterolaterals large and conspicuously elevated; epibranchials conspicuous; anterior mesobranchial two discrete patches, both elevated, one much smaller than the other; central mesobranchial,

linear patch; posterior mesobranchial, short line or patch; cardiacs conspicuously elevated with tuberculate or spiniform tips; lateral postcardiacs resolvable into three or four tubercle-like clusters of granules; median postcardiac conspicuously elevated ridge or spine; posterolaterals, forming curved arc, terminated anteriorly with forwardly directed spinelike tubercle. In one case two spines on posterolaterals, also two on lateral postcardiacs, and one on posterior mesobranchial. In another case approximately four spines on posterolaterals and one on posterior mesobranchial.

Chelipeds: Right larger. With well-developed spines, covered by fine pile overlying squamiform markings. Posterior border of arm bearing two sharp spines, anterior border with three unusually large sharp spines, middle the largest. Wrist with large inner and outer spines. Upper surface of hand with two spines (excluding that at wrist articulation), outer near the finger articulation, inner a little distance back. Spines better developed on smaller left chela. Two granular carinae on upper surface of hand, two less developed ones on outer surface, and one barely recognizable on inner surface. Spaces between carinae, also under surface, with conspicuous squamiform markings.

Fifth leg: Merus very short (length almost exactly equalling breadth) with finely denticulate posterior border.

Third maxilliped: Anterior portion of merus produced strongly forward but not laterally.

Male abdomen: Penultimate segment elongate and with concave borders, ultimate segment, cordiform, slightly more than half length of penultimate.

Male first pleopod: Short, stout, regularly curving to pointed tip.

REMARKS.—This species keys out in Stephenson and Campbell (1959) with *P. tweediei*, *P. tenuipes*, *P. mariei*, and *P. alcocki* but differs from all in the elevated spiniform areas on the posterior portion of the carapace.

It is clearly separable from *P. rugosus* by two spines on the posterior border of the arm.

Portunus spinipes (Miers)

FIGURE 14

Neptunus (*Amphitrite*) *spinipes* Miers, 1886, pp. 178–179, pl. 15 (figs. 1a–c).

Neptunus (*Hellenus*) *spinipes* Miers.—Gordon, 1931, p. 534 (under *N. pulchricristatus*), figs. 9, 10a.

Not *Neptunus* (*Hellenus*) *spinipes* Alcock, 1899, pp. 31–32, 39–40 (= *P. pulchricristatus* (Gordon)).

MATERIAL.—Philippines: Sta. 5164, Observation I., Sulu Archipelago, Tawitawi Group, 18 fm., green mud, Feb. 24, 1908, *Alb.*, 2

males (wet), 3 males, 1 female (dried); Sta. 5181, Antonia I., eastern Panay, 11°36′40″N., 123°26′35″E., 26 fm., Mar. 27, 1908, *Alb.*, 1 *Sacculina* infected male; Sta. 5642, Buton Strait, 4°31′40″S., 122°49′42″E., 37 fm., grey mud, Dec. 14, 1909, *Alb.*, 5 males, 6 females; Sta. 5644, Makassar I., Buton Strait, 5°27′24″S., 122°38′00″E., 22 fm., Dec. 16, 1909, *Alb.*, 1 male (damaged).

MEASUREMENTS.—Males, 16–26 mm.; females, 18–24 mm.; *Sacculina* infected male, 15 mm.

REMARKS.—Gordon has shown that Alcock's *Neptunus spinipes* differs from Miers' and has listed the distinctions as well as giving figures of the carapaces and male pleopods of the two species. Her figure of the carapace of one of the cotypes differs noticeably from

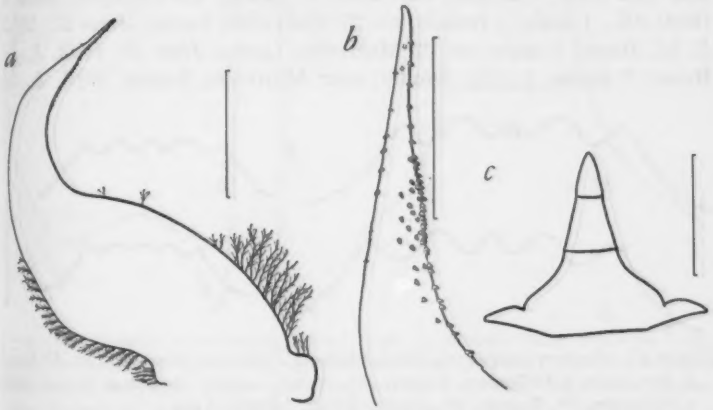

FIGURE 14.—*Portunus spinipes* (Miers), male, Philippines, Sta. 5642, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.1 mm.; *c*, 5 mm.)

Miers' figure in having a much less prominent front. The present specimens resemble her figure.

The male pleopods are refigured. The species is incorrectly placed in the key of Stephenson and Campbell (1959) because the posterior-posterolateral junction of the carapace is obtuse.

DISTRIBUTION.—Apparently only known previously from Miers' material, from the Philippines, and close to *Albatross* Sta. 5181, viz 11°37′00″N., 123°31′00″E.

Portunus tenuipes (de Haan)

FIGURE 15

Amphitrite tenuipes de Haan, 1835, p. 39, pl. 1 (fig. 4).
Neptunus tenuipes (de Haan).—A. Milne Edwards, 1861, pp. 335, 339.

Neptunus (*Hellenus*) *tenuipes* (de Haan).—Alcock, 1899, p. 42.—Shen, 1937, p. 104, figs. 4, 8.

Neptunus (*Amphitrite*) *tenuipes* (de Haan).—Sakai, 1939, pp. 389–390, pl. 80 (fig. 2).

Portunus tenuipes (de Haan).—Guinot, 1957, p. 480 (under *P. mariei*).—Stephenson and Campbell, 1959, pp. 103–104, figs. 2E, 3E, pls. 2 (fig. 1), 4E, 5E.

MATERIAL.—Philippines: Subig Bay, shore, seine, Jan. 7, 1908, *Alb.*, 4 males (1 *Sacculina* infected), 2 females, 3 ovig. females; Port Binanga, ship's side, Jan. 8, 1908, *Alb.*, 2 females; Tachloban Anchorage, about ship, hand dredge, 3 fm., Apr. 12, 1908, *Alb.*, 1 ovig. female; Busin Harbor, Burias Is., electric light, Apr. 22, 1908, *Alb.*, 2 males; Surigao, Mindanao, 150 ft. seine, May 8, 1908, *Alb.*, 1 male, 1 female; Davao, Mindanao, 150 ft. seine, May 16, 1908, *Alb.*, 1 male, 1 female; near Sta. 5459, Cabugao, east coast of Luzon, electric light, June 9, 1909, *Alb.*, 1 male, 1 female; no. 27 Mariveles, Luzon, June 27, 1913, A. M. Reese, 1 male; no. 33 Mariveles, Luzon, June 28, 1913, A. M. Reese, 5 males, 1 ovig. female; near Mariveles, Luzon, 1913, A. M. Reese, 1 male; Waigin, tide pool, June 8, 1929, Herre collection, 1 male.

FIGURE 15.—*Portunus tenuipes* (de Haan), fronts: *a*, Philippines, Mariveles, No. 33, Reese, 32 mm. male; *b*, Philippines, Surigao, *Alb.*, 36 mm. male; *c*, same as *a*, 22 mm. male; *d*, Philippines, Pt. Binanga, *Alb.*, 16 mm. female. (Scale=5 mm.)

MEASUREMENTS.—Males, 14–36 mm.; females, 16–35 mm.; ovig. females, 22–25 mm.

REMARKS.—As specimens become larger, the frontal lobes become more acute and prominent (see fig. 15).

Distribution.—Andamans to Japan and the Philippines, including Australia.

Portunus trituberculatus (Miers)

FIGURES 16, 17*a*

Portunus pelagicus de Haan (not Linnaeus) 1835, p. 37, pls. 9, 10.

Neptunus trituberculatus Miers 1876b, p. 222; 1886, p. 172.—Sakai, 1934, p. 303; 1936, p. 129, pl. 37.

Portunus trituberculatus (Miers).—Rathbun 1902, p. 26.—Stephenson and Campbell, 1959, p. 90 (in key).—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

Neptunus (*Neptunus*) *trituberculatus* (Miers).—Sakai, 1939, p. 388, pl. 50.

MATERIAL:—East Africa: Ras Banas, Red Sea, 1950, Sozon Vatikiotis, 1 male, 3 females.[3]

Malay Peninsula: S.1166, Singapore, "China," Arthur de Sowerby, 1 male.

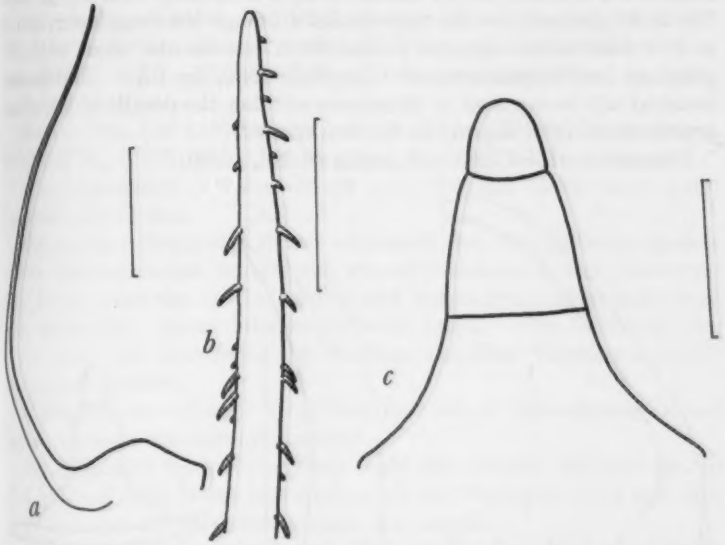

FIGURE 16.—*Portunus trituberculatus* (Miers), male: *a*, pleopod, Malay Peninsula, Singapore, de Sowerby; *b*, pleopod tip, upper surface, same specimen; *c*, abdomen, E. Africa, Ras Banas, Vatikiotis. (Scale=*a*, 10 mm.; *b*, 1 mm.; *c*, 5 mm. Identity of specimen now doubtful.)

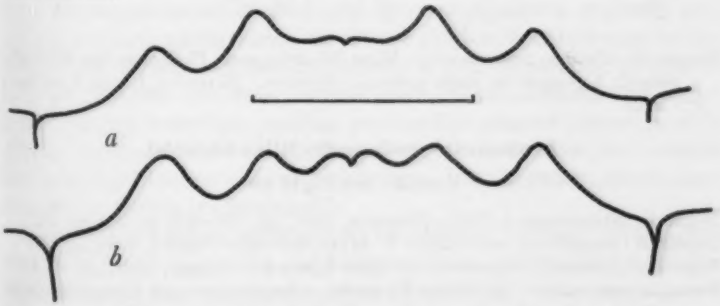

FIGURE 17.—Fronts. *Portunus trituberculatus* (Miers): *a*, East Africa, Ras Banas, Vatikiotis, 56 mm. female (identity of specimen now doubtful). *P. pelagicus* (Linnaeus): *b*, Philippines, Sta. 5346, *Alb.*, 66 mm. female. (Scale=5 mm.)

[3] Doubts have arisen concerning the identity of these specimens, which may be reported on in a later publication.

China: S.1165, China, 1925–1927, Arthur de Sowerby, 1 female. (Probably like the last specimen, this came from Singapore.)

MEASUREMENTS.—Males, 45–180 mm.; females, 45–90 mm.

REMARKS.—This species is very close to *P. pelagicus*, and the difference in the fronts is shown better by figures than by words (fig. 17). The male pleopods are also very similar although the overall curvature in *P. trituberculatus* departs farther from the circular than with *P. pelagicus* (see Stephenson and Campbell, 1959, fig. 2A). Additional material will be required to determine whether the details of terminal armature do differ slightly in the two species.

DISTRIBUTION.—China and Japan (Sakai, 1939).

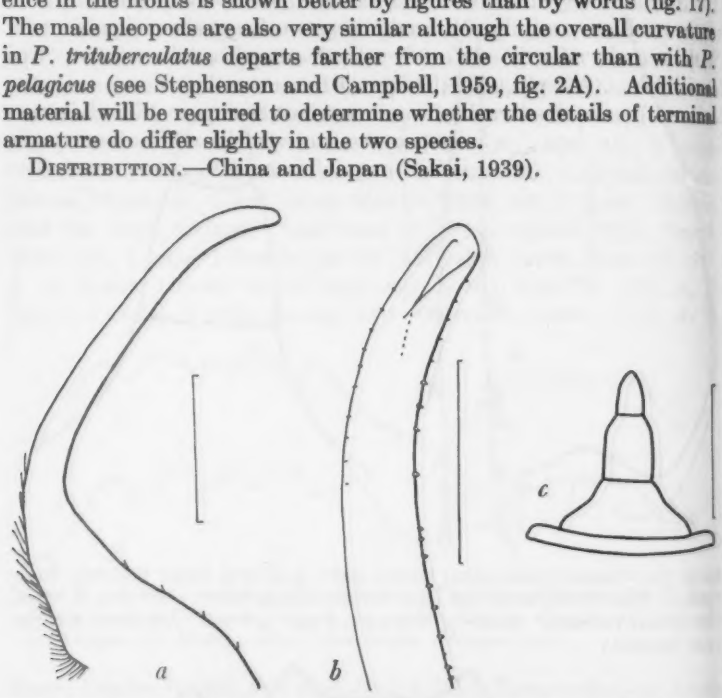

FIGURE 18.—*Portunus tuberculosus* (A. Milne Edwards), male, Philippines, Sta. 5159, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.5 mm.; *c*, 5 mm.)

***Portunus tuberculosus* (A. Milne Edwards)**

FIGURES 18; PLATE 6B

Neptunus tuberculosus A. Milne Edwards, 1861, pp. 333–334, pl. 31 (fig. 5).
Neptunus (Amphitrite) tuberculosus A. Milne Edwards.—Miers, 1886, p. 176.
Neptunus (Hellenus) tuberculosus A. Milne Edwards.—Alcock, 1897, pp. 42–43.
Portunus tuberculosus (A. Milne Edwards).—Stephenson and Campbell, 1959, p. 89 (in key).—Crosnier, 1962, pp. 69–71, figs. 97–98, 124–127.

MATERIAL.—China: Sta. 5309, China Sea, vicinity Hong Kong, 21°53′N., 115°51′E., 62 fm., green mud, Nov. 4, 1908, *Alb.*, 1 female.

Philippines: Sta. 5104, China Sea off southern Luzon, 14°45′48″N., 120°12′20″ E., Jan. 8. 1908, *Alb.*, 1 male, 1 female, 1 ovig. female;

Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″ N., 119°54′E ., Feb. 21, 1908, *Alb.*, 1 male; Varadero Bay, Mindanao, 10:30–11:30, electric light, July 22, 1908, *Alb.*, 1 female; Sta. 5442, west coast of Luzon, South Fernando Point Light, 16°30′36″N., 120°11′06″E., 45 fm., coarse sand, May 11, 1909, *Alb.*, 7 males, 1 female, 2 ovig. females; Sta. 5478, Tacbuc Point, (Leyte), 10°46′24″ N., 125°16′30″E., July 29, 1909, *Alb.*, 1 female; Sta. 5642, Buton Strait, 4°31′40″S., 122°49′42″E., 37 fm., grey mud, Dec. 14, 1909, *Alb.*, 1 male.

Palau: Sta. 125–1187 Palau I., about 1¾ mi. NE. of Ngabadongu, 7°17′36″N., 134°21′42″E., 17 fm., Aug. 24, 1955, GVF., 1 female.

Measurements.—Males, 18–49 mm.; females 15–30 mm.; ovig. females, 21–26 mm.

Remarks.—Originally it was suspected that two different species were present, some being more strongly embossed and possessing spiniform tubercles on the cardiac and lateral postcardiac regions of the carapace. Later intergrades were found. The following, the only adequate description in English, amplifies Crosnier's (1962) French description.

Description.—Front: Projecting, four round, approximately equal lobes, medians the more prominent.

Anterolateral teeth: Irregularly sized and spaced, first and second almost confluent, fourth and sixth small and depressed, third and fifth with enlarged granular bases, ninth the longest.

Carapace: Moderately broad (B/L.=1.6–1.7). Regions varying from moderately to very strongly embossed, and carrying beaded granules or occasionally tubercles. Strongly depressed posterior to protogastric and mesogastric areas. Main granular patches as follows: Protogastrics subdivided into two; mesogastrics, typically two oblique patches; metagastrics, transverse ridge with anterior prolongation; cardiacs either an elevated patch, or pair of patches, or pair of elevated granular tubercles; lateral postcardiacs elevated and sometimes bearing tubercles; median postcardiac present; anterolaterals diffuse; epibranchials with marked change in curvature near middle and interrupted on cervical groove to form discrete patch; three mesobranchials; diffuse posterolateral.

Chelipeds: Elongate, right slightly the stouter. Upper surfaces covered with beaded granules and lower surfaces, particularly of hands, bearing squamiform markings. Anterior border of arm bearing two spines typically followed by a tubercle, occasionally by a third spine. Posterodistal border with single spine. (Crosnier describes two teeth, the second "méritant à peine le nom de dent.") Wrist normal. Upper surface of hand bearing three granular carinae of which innermost terminates in distal spine or spiniform tubercle. Conspicuous

carinae on outer surface of hand, but inner carina represented only by double row of enlarged granules.

Fifth leg: Merus short (L/B=1.2). Posterior border composed of rounded granules or spinules.

Third maxilliped: Anterior border of merus produced forward and a little laterally.

Male abdomen: Penultimate segment about 1.3 times as long as broad and with gently curving sides. Ultimate segment about 2.5 times as long as broad.

Male first pleopod: Sharply curved near middle and slightly curved behind tip which is blunt, and bears only microscopic spinules (see fig. 18*b*).

The present material differs from Crosnier's (1962) figure (fig. 12*d*) in having blunter first anterolateral teeth, epibranchial ridge of carapace often ending in a swollen granulated patch, and posterolateral angle of the carapace generally much sharper.

In the fragmented specimen from Sta. 5642, Dec. 14, 1909, *Alb.*, the left anterior branchial region is swollen as if from a parasite.

The species is clearly separable from *P. macrophthalmus* Rathbun, *P. emarginatus* Stephenson, and *P. tenuicaudatus* Stephenson by differences in the detailed ornamentation of the carapace.

DISTRIBUTION.—Madagascar, Persian Gulf, Ceylon, Hawaii.

Portunus tweediei (Shen)

FIGURE 19

Neptunus (*Hellenus*) *tweediei* Shen, 1937, p. 109, fig. 6.
Portunus tweediei (Shen).—Stephenson and Campbell, 1959, p. 90 (in key).

MATERIAL.—Malay Peninsula: Thailand, entrance to Trat Bay, Gulf of Thailand, flat mud bottom, 5 m., 11°58′30″N., 102°44′05″E., GVF, Sta. 26, Oct. 29, 1957, 1 fragmented female.

Philippines: Manila Bay, off Eremita, June 5, 1907, *Alb.*, 1 male, 2 ovig. females; Manila Bay, Dec. 7, 1907, *Alb.*, 1 male; Manila Bay, outside of breakwater, mud, small rocks, Dec. 12, 1907, *Alb.*, 41 males, 23 females (3 ovig.), 1 juv; Little Harbor at Lunela, Manila Harbor, Dec. 12, 1907, *Alb.*, 1 male, 1 female; Tacloban Anchorage, about ship, hand dredge, Apr. 12, 1908, *Alb.*, 1 male; Sta. 5346, Cliff I., Malampaya Sound, Palawan Is., seine, gravel, rocks, Dec. 29, 1908, *Alb.*, 1 ovig. female.

MEASUREMENTS.—Males, 8–21 mm.; females, 7–16 mm.; ovig. females, 15–25 mm.; juv., 10 mm.

REMARKS.—The posterior-posterolateral junctions of the carapace are possibly more spinous than indicated by Shen; frontal teeth are a little more rounded; the postcardiac granular patch is lozenge

shaped instead of triangular; and the mesobranchial granular patches are arranged slightly differently. The male abdomen is longer and thinner (particularly so in the smaller specimens) with penultimate segment tapering from halfway along its length, and ultimate almost twice as long as broad and with a rounded tip. The male pleopod is more robust centrally and more pointed distally than figured by Shen. However, details of terminal armature coincide with Shen's figure 8d. The present specimens, which include some obviously mature, are all much smaller than Shen's.

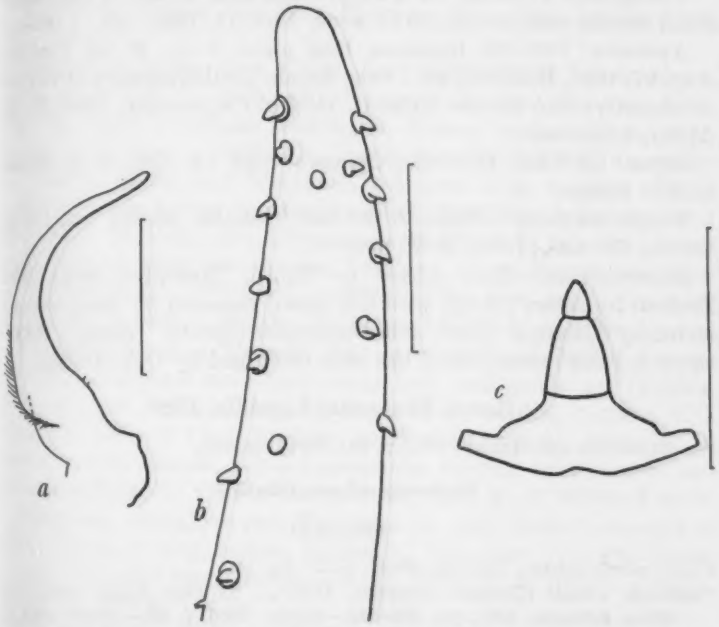

FIGURE 19.—*Portunus tweedei* (Shen), male, Philippines, Tacloban, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.1 mm.; *c*, 5 mm.)

DISTRIBUTION.—Previously known only from Singapore (Shen, 1937).

Genus *Scylla* de Haan, 1833

Scylla serrata (Forskål)

Cancer serratus Forskål, 1755, p. 90.

Scylla serrata (Forskål).—Stephenson and Campbell, 1960, pp. 111–115; fig. 2N, pls. 4 (fig. 4), 5N, 6C.—Crosnier, 1962, pp. 72–73, figs. 128, 129.—Miyake, Sakai, and Nishakawa, 1962, p. 128 (record only).—Dell, 1964b, pp. 59–62.

MATERIAL.—East Africa: Strait at Changamive, 3¾ mi. from Mombasa, Nov. 21–30, 1909, E. A. Mearns, 2 males.

Malay Peninsula: Menam at Paknam, Siam, July 5, 1923, H. M. Smith, 1 juv; Chao Phya River, Paknam, Siam, June 3, 1927, H. M. Smith, 1 male, 1 juv; Bangpa Kong River, Siam, June 4, 1928, H. M. Smith, 3 males, 1 female; Sta. 10002, from Thailand, purchased, received Aug. 24, 1955, R. E. Elbel, 1 male.

China: U.S. Nav. Med. Res. Unit 2, Taipei, Formosa, purchased, received Feb. 13, 1958, R. E. Kuntz, 1 male.

Philippines: Port San Pio Quinto, China Sea, vicinity of Batanes, in small stream near mouth, 20 ft. seine, Nov. 11, 1908, *Alb.*, 1 male.

Australia: U42–728 Ironstone Reef about 3 mi. W. of Yirrkala, Aug. 27, 1948, R. R. Miller, 1 ovig. female; Little Lagoon and vicinity northeastern end Groote Eylandt, Gulf of Carpentaria, 1948, R. R. Miller, 2 females.

Japan: OPM958, Hentonia, Okinawa, Sept. 19, 1945, O. A. Muennink, 1 female.

MEASUREMENTS.—Males, 29–88 mm.; females, 26–123 mm.; ovig. female, 170 mm.; juvs., 26–28 mm.

DISTRIBUTION.—East Africa to Tahiti. Recorded from New Zealand by Miers (1876), with the record repeated by later workers including Chhapgar (1957) and Stephenson (1961b). Hutton (1882) suspected this record, but it has been confirmed by Dell (1964b).

Genus *Thalamita* Latreille, 1829

See Stephenson and Hudson, 1957, p. 361, for synonymy.

Thalamita admete (Herbst)

FIGURE 20

Cancer admete Herbst, 1803, pp. 40–41, pl. 57 (fig. 1).

Thalamita admete (Herbst).—Latreille, 1829, p. 33 (fide Miers, 1886).—A. Milne Edwards, 1861, pp. 356–357.—Heller, 1865, p. 28.—Miers, 1884, p. 230.—Ortmann, 1893, p. 83.—Borradaile, 1900, p. 579.—Calman, 1900, p. 23.—Lenz, 1905, p. 362.—Rathbun, 1907, p. 63.—Nobili, 1907, p. 383.—Rathbun, 1911, p. 208.—Edmondson, 1923, p. 1550; 1925, p. 37; 1954, pp. 255–256, figs. 30a,b, 31a–e.—Sakai, 1939, pp. 414, 421–422, pl. 85 (fig. 1).—Ward, 1942, p. 80.—Barnard, 1950, p. 176, fig. 33c.—Holthius, 1953, p. 7.—Stephenson and Hudson, 1957, pp. 320, 324–326, figs. 2I, 3I, pls. 1 (fig. 1), 7A, 10A.—Stephenson, 1961a, p. 117.—Forest and Guinot, 1961, p. 30, figs. 19a,b.—Sankarankutty, 1961a, p. 106; 1961b, p. 122.—Crosnier, 1962, pp. 96–97, figs. 154, 157, 162–164, 168.

Thalamita savignyi A. Milne Edwards, 1861, pp. 357–358, 367.—Ortmann, 1894, p. 46.

Thalamita admeta (Herbst).—Alcock, 1899, pp. 82–84.—Tweedie, 1950a, p. 84, fig. 2b.

Thalamita admete var. *edwardsi* Borradaile, 1900, p. 579.—Nobili, 1907, p. 383.

Thalamita admeta var. *A admeta* Borradaile, 1902, pp. 202–203.
Thalamita admeta var. *B edwardsi* Borradaile, 1902, pp. 202–203.
Thalamita admeta var. *C savignyi* Borradaile, 1902, pp. 202–203.
Thalamita edwardsi Borradaile.—Rathbun, 1906, p. 873.—Edmondson, 1925, p. 37; 1954, pp. 254–255, figs. 28b, 29a–d.—Forest and Guinot, 1961, p. 32, figs. 20a, b.—Crosnier, 1962, p. 98, fig. 158.—Guinot, 1962, pp. 2–3.
Thalamita admeta var. *savignyi* Borradaile.—Nobili, 1906a, pp. 202, 206–208.
Thalamita dispar Rathbun, 1914, p. 657, pl. 1, fig. 4.
Thalamita admeta var. *savignyi* Borradaile.—Laurie, 1915, pp. 440–441.
Thalamita ?edwardsi Borradaile.—Holthius, 1953, p. 8.
?*Thalamita spiceri* Edmondson, 1954, pp. 258–260, fig. 33a–e.

MATERIAL: China: Nau Wan, Formosa, China Sea, Jan. 27, 1910, *Alb.*, 1 male.

Philippines: Subig Bay, China Sea off southern Luzon, shore, seine, sand, Jan. 7, 1908, *Alb.*, 1 female; Tataan, Simaluc, shore, Feb. 19, 1908, 1 female; Guijulugan, Negros, station shore, sand, gravel, mud, Apr. 2, 1908, *Alb.*, 1 ovig. female; Makinog, Camiguin I., between Leyte and Mindanao, tide pool, Aug. 3, 1909, *Alb.*, 5 males, 1 female, 4 ovig. females; Sta. 5561, Tutu Bay (Jolo), coral and sand, Sept. 19, 1909, *Alb.*, 1 female; Great Tobea I., tide pool, sand, coral, Dec. 15, 1909, *Alb.*, 3 males, 2 females, 1 ovig. female; Makasser I., Buton Strait, 5°27′24″S., 122°38′00″E., tide pools, Dec. 16, 1909, *Alb.*, 1 male, 1 female; Philippine Is., E. A. Mearns, 1 male.

Australia: Reef at Yirrkala, July 12, 1948, R. R. Miller, 1 male; M.48–21, ironstone reefs (not coral) and rock pools at Yirrkala, NW. of Cape Arnhem, Aug. 6, 1948, R. R. Miller, 2 males; C–7 Yirrkala, NW. of Cape Arnhem, coral reef, Aug. 25, 1948, R. R. Miller, 1 ovig. female; Little Lagoon and vicinity, northeastern end of Groote Eylandt, Gulf of Carpentaria, 1948, R. R. Miller, 1 male.

Melanesia: Malaluva reef, Fiji, June 19, 1922, State University of Iowa, 1 male, 1 ovig, female; Ovalau I., Fiji, Mar. 17, 1929, Herre, 1 male, 1 female; New Georgia, Jan. 10, 1945, W. A. Bartos, 4 males, 3 females, 1 ovig. female.

Marianas: No. 83/X–48, Piti Bay, Guam, June 30, 1945, McElroy and Baker, 1 ovig. female; 145/RHB–150, Agfayan Bay, Guam, July 17, 1945, R. H. Baker, 1 male; Saipan, in coral heads, 1945, A. H. Banner, 2 males, 1 female, 1 juv; Y–128G, from under rocks, tidal flats, Tomil Harbor, 1952, Hiatt, 1 male; Y–193 B, C, from under rocks, tidal flats of Balabat, Yap Is., 1952, Hiatt, 3 males, 1 female; 177–G–1, Ifaluk, Caroline Is., 1953, F. M. Bayer, 9 juvs.

Japan: Tanego Shima, 1906, *Alb.*, 1 female.

Marshalls: Eniwetok, reef, low tide, February 1940, Ziesenhenne, 2 males; no. 4331, Sta. 6, one-third mi. W. of Southeast Point, Bikini I., Apr. 23, 1946, J. P. E. Morrison, 1 female; no. 4351, Sta. 4, one-third mi. SW. of southeastern point, Bikini I., 3½ fm., forams,

sand, Apr. 23, 1946, 1 female; no. 49, Bikini I., outer reef flats, July 22, 1947, F. M. Bayer, 1 male.

Hawaii: Black Point, Haunama Bay, Oahu, 1937, L. R. Woodward,

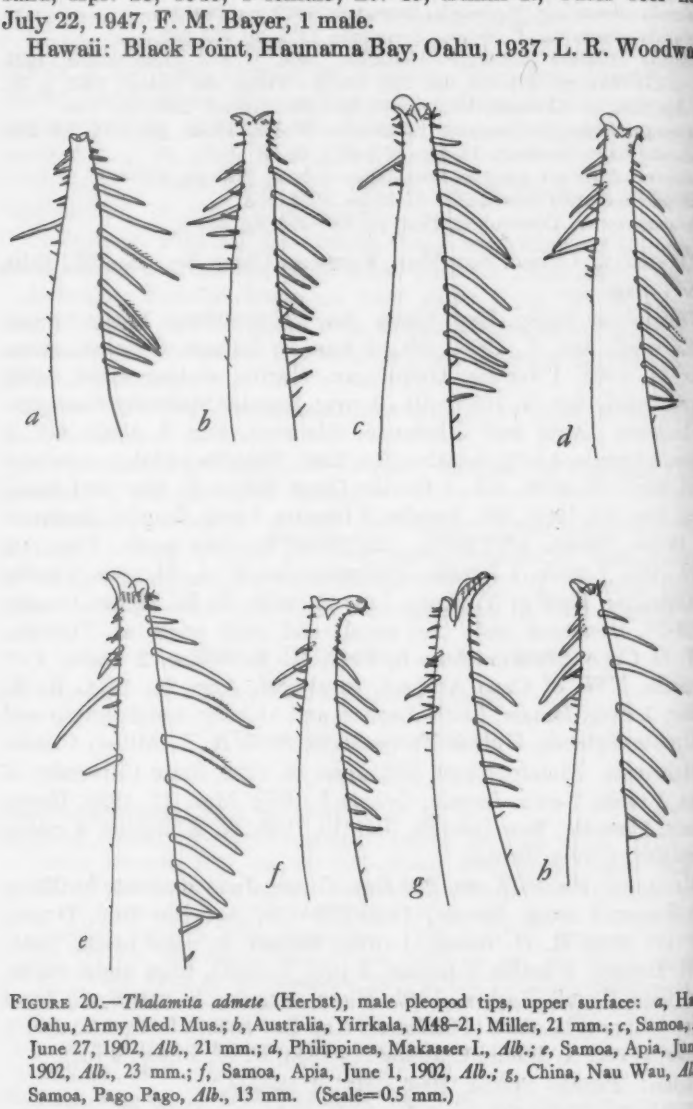

FIGURE 20.—*Thalamita admete* (Herbst), male pleopod tips, upper surface: *a*, Hawaii, Oahu, Army Med. Mus.; *b*, Australia, Yirrkala, M48–21, Miller, 21 mm.; *c*, Samoa, Apia, June 27, 1902, *Alb.*, 21 mm.; *d*, Philippines, Makasser I., *Alb.*; *e*, Samoa, Apia, June 27, 1902, *Alb.*, 23 mm.; *f*, Samoa, Apia, June 1, 1902, *Alb.*; *g*, China, Nau Wau, *Alb.*; *h*, Samoa, Pago Pago, *Alb.*, 13 mm. (Scale=0.5 mm.)

S. F. Light, 1 male, 2 females; Mokuleia, Oahu, shallow water, reef, 1938, Degener, 2 males, 1 female, 1 juv; Waikiki Marine Lab., under stones, near shore, Feb. 9, 1942, G. S. Mansfield, 1 male; Waikiki

Marine Lab., Feb. 12, 1942, G. S. Mansfield , 1 male, 1 female; Waikiki Marine Lab., Mar. 6, 1942, G. S. Mansfield, 2 males; Waikiki Marine Lab., Mar. 13, 1942, G. S. Mansfield, 1 male, 1 female, 2 ovig. females; Waikiki Marine Lab., Mar. 22, 1942, G. S. Mansfield, 3 males; Waikiki Marine Lab., Mar. 23, 1942, G. S. Mansfield, 2 males, 1 female, 1 ovig. female; Waikiki Marine Lab., Mar. 28, 1942, G. S. Mansfield, 2 females; Waikiki Marine Lab., Apr. 6, 1942, G. S. Mansfield, 1 male, 1 female, 1 ovig. female, 2 juvs; Waikiki Marine Lab., Apr. 24, 1942, G. S. Mansfield, 6 males, 2 females; off Waikiki Marine Lab., Apr. 30, 1942, G. S. Mansfield, 1 female; Oahu, 1945, Army Medical Museum, 1 male, 2 ovig. females; Hanauma Bay, Oahu, July 13, 1945, Army Medical Museum, 1 male.

Tuamotus and Societies: Society Is., summer 1945, J. M. Clements, 2 males; remainder Bredin Exped. 1957; Sta. 3–57, Papeete Harbor, Tahiti, anchor chain, April 8, 3 males, 2 females, 2 ovig. females; Sta. 14a–57 Tikahau Atoll, Tuamotus Is., from *Holothuria atra*, ocean reef, April 12, 7 males (1 damaged), 2 females, 2 ovig. females; Sta. 51–57 Bora Bora, three-eighths mi. S. of Farepiti Point, fringing reef 2–3 ft. in algae in sand, April 23, 1 juv; Sta. 56–57, 57–57, Bora Bora, dredged, April 25, 1 male; Sta. 62–57, Bora Bora, inner edge of outer reef, April 25, 2 males; Sta. 64–57 Motu Tapu Is., Bora Bora Is., along northwestern shore, shallow water, April 26, 2 males, 2 females; Sta. 75–57, E. of dock at Uturoa, Raiatea, from coral boulders in muddy water, April 28, 1 female; Sta. 86–57, Baie de Bourayne, Huahine, sandy reef, May 1, 1 male, 1 ovig. female; Sta. 106–57, Moorea, northwestern Motu Fareme I., fossil coral along shore, May 8, 1 male; Sta. 127–57, Moorea, Nuarei Bay, coral in shallow sandy beach, May 11, 2 males.

Samoa: Apia, at mouth of river, June 1, 1902, *Alb.*, 1 male; Apia, outer reef, June 27, 1902, *Alb.*, 3 males, 1 female; Apia, outer coral reef at low tide, July 1, 1902, *Alb.*, 1 female; Pago Pago, August 1902, *Alb.*, 4 males, 4 females (1 *Sacculina* infected), 3 ovig. females; Canton I., 1941, C. A. Ely, 7 males, 8 females, 3 ovig. females; Canton I., Lagoon West, in coral head near Flemings, January 1942, C. A. Ely, 2 females, 3 ovig. females; Tafuna, Tutuila, Jan. 9, 1949, L. Zachowski, 1 female.

Fanning Is.: Inner Lagoon, Dec. 16, 1913, Fred and Charlotte Baker, 3 males, 2 females.

Measurements.—Males, 6–38 mm.; females, 6–ca. 28 mm.; ovig. females, 8–29 mm.; juvs. 5–8 mm.

Remarks.—A few specimens from Makinog (Cumigium I., between Leyte and Mindanao, tide pool, Aug. 3, 1909, *Alb.*) have one side of the front bilobed. One of the females has only third and fifth anterolateral teeth on the right side.

A female from Black Point (Haunama Bay, Oahu, T.H., 1937, L. R. Woodward, S. F. Light) lacks the second anterolateral tooth on the right.

In 1957, Stephenson and Hudson gave an extensive synonymy for this species. A further extension to include *T. dispar* has been given by Stephenson (1961a).

Since then Forest and Guinot (1961) have revived *T. edwardsi* Borradaile as a separate species on the basis of three specimens from Tahiti which included a single mature male. The bases of separation of *T. edwardsi* from *T. admete* concern the general facies, and also, according to Forest and Guinot, the structure of the male pleopods. *T. edwardsi* is supposed to be distinguishable on general facies by the following: Cardiac ridges of carapace absent; posterior mesobranchial ridges absent; hands of chelae smoother and with ill-developed carinae; and fourth anterolateral tooth either absent or rudimentary.

Forest and Guinot distinguish the male pleopods of *T. edwardsi* by large subterminal bristles of outer surface of irregular size and the row not extending so far (relatively) backward from the tip, and by large subterminal bristles of inner surface slightly more numerous (relatively) and extending farther backward from the tip.

As regards general facies, Stephenson and Hudson (1957) on the basis of 152 specimens stated (pp. 31–32):

> . . . the only dubious point appears to be the status of Borradaile's "var. *edwardsi*," which is typified by the carination and granulation of the outer surface of the hand of the chelipeds. The existence of gradations between smoothness and carination, and the absence of correlated characters which would serve for distinction, suggests that this "variety" should not be retained.

Since then, field examination of several hundred further specimens has confirmed the gradations in cheliped structure and failed to reveal features of color, habitat, or behavior, which merited a detailed reinvestigation of the situation.

As regards pleopod structure, figures already published cast doubt upon the distinguishing criteria of Forest and Guinot. Thus the outer surface of the figure of Stephenson and Hudson (1957, fig. 3I) resembles their *T. admete*, while the inner surface resembles their *T. edwardsi*. To obtain unequivocal data, 25 males were selected at random from the present collection. Since specimens with carinated chelae predominated, five males with smoother chelipeds (the first five encountered) were added. The total was examined for seven of the supposedly distinguishing features of *T. edwardsi* from *T. admete*, and the results given in table 1 (p. 113) are arranged with *T. edwardsi*-like specimens first and *T. admete*-like specimens last. In certain features, particularly those of the pleopods, it was difficult

to place a given specimen in a definite category, but wherever possible this was attempted.

The results show that there is every gradation from specimens which might be categorized "6/7 *edwardsi* and 1/7 *admete*" to those which are "7/7 *admete*," and that there is a lack correspondence between any two features.

Several pleopods are figured (fig. 20). These show intermediates between the two figured by Forest and Guinot and extend the range beyond their limits. A further extension is provided by Stephenson and Hudson (1957, fig. 3I).

Following the publications of Crosnier (1962) and Guinot (1962), the entire collection was reinvestigated separately by each of the present authors who agreed that, if two forms were present, the only hope of separation lay in the carination of the outer surface of the chelipeds. Investigation then showed that in some specimens both upper and middle carinae are strongly developed and granular. In others the upper carina is strongly granular and the middle one, while strongly developed, is without granules. In yet others the upper carina of the smaller cheliped is granular but that of the larger, nongranular. In others there is a distinct but smooth lower carina, while the upper one is barely distinguishable or indistinguishable. Finally in some, the upper carina has disappeared, and the lower one is distinguishable with difficulty or not at all. In other words there is a complete gradation between extremes.

T. spiceri, based upon three females, remains a doubtful synonym. Edmondson compares it with *T. pilumnoides* but not with *T. admete*, which it appears to resemble closely.

DISTRIBUTION.—Red Sea and East Africa to Hawaii and Tahiti, including Japan and Australia.

Thalamita auauensis Rathbun

FIGURES 21, 22

Thalamita auauensis Rathbun, 1906, p. 874, pl. 12 (fig. 1).—Edmondson, 1951, p. 222, fig. 24b; 1954, pp. 257–258, figs. 32a–d.—Stephenson and Campbell 1957, pp. 319, 320 (in key).

MATERIAL.—China: Sta. 5321, Ibugos Is., China Sea, Formosa, 20°19′30″ N., 121°51′15″ E., 26 fm., white sand, coral, broken shells, Nov. 9, 1908, *Alb.*, 1 male.

Philippines: Sta. 5557, Sept. 18, 1909, *Alb.*, 1 ovig. female; Great Tobea I., tide pool, sand, coral, Dec. 15, 1909, *Alb.*, 1 female.

Marianas: 148/R.H.B.–155, Ritidian Point, Guam, July 12, 1945, R. H. Baker, 1 ovig. female; Guam, October–November 1945, J. L. Gressitt, 1 ovig. female; Saipan, in coral heads, 1945, A. H. Banner, 1 juv; 177–G–1, Ifaluk, Caroline Is., 1953, F. M. Bayer, 2 juvs.

(also 7 juvs. of a species near this but too small to identify positively).

Samoa: U.01096, 1 ovig. female.

MEASUREMENTS.—Male, 17 mm; female, 21 mm; ovig. females, 11–20 mm; juvs., 4–5 mm.

REMARKS.—Very close to *T. admete* in its general facies and also in its pleopod structure and distinguished by: Carapace being more convex and typically more hirsute; granulation between two lowermost ridges on outer side of chelae; more inclined borders of penultimate segment of male abdomen and more elongate ultimate segment; and by marked reduction in spinulation of male pleopods (see figs.

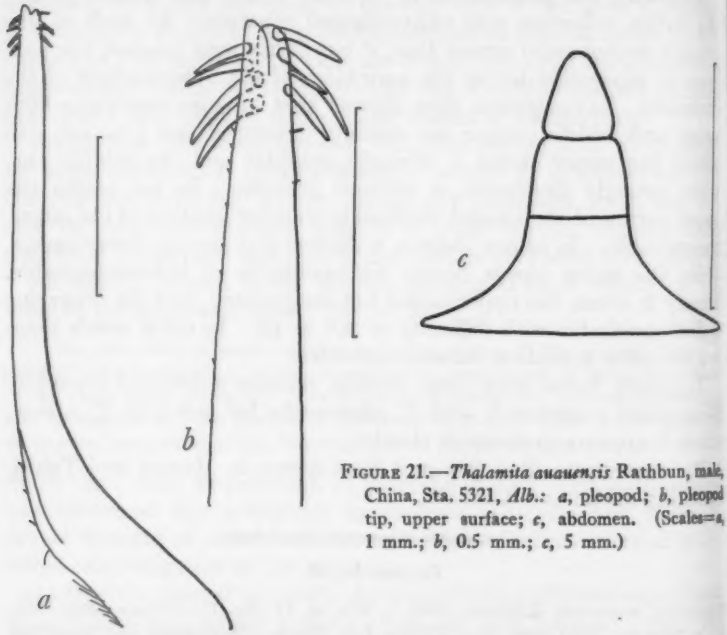

FIGURE 21.—*Thalamita auauensis* Rathbun, male, China, Sta. 5321, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.5 mm.; *c*, 5 mm.)

21*a*,*b*). Only four slightly recurved stout bristles of more or less uniform size are present on each.

Evidently the size of the fourth anterolateral tooth varies as in *T. admete*. Rathbun (1906) describes this tooth as rudimentary, while Edmondson (1954) implies that it is either very small or absent. Edmondson comments on the bright pink color of specimens.

The species is also close to *T. granosimana* Borradaile and was listed as a queried synonym of this species by Stephenson (1961a, pp. 119–121). It differs in the armature of the male pleopods, in the penultimate segment of the male abdomen being less parallel sided

and ultimate segment longer, and in having a more convex carapace.

The front varies in the curvature of both inner orbital lobes and frontal lobes.

Edmondson (1951, fig. 24b; 1954, fig. 32a) does not show the conspicuous frontal ridges which are clearly visible in Rathbun's (1906) plate 12, figure 1. In his figures he shows what appears to be a ridge which continues behind the orbit; in the present specimens this is a groove, not a ridge.

DISTRIBUTION.—Previously known only from Hawaiian waters.

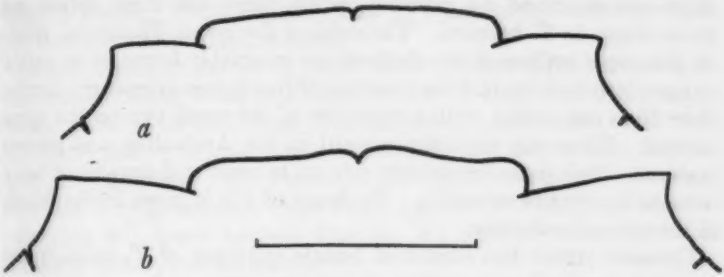

FIGURE 22.—*Thalamita auauensis* Rathbun, fronts: *a*, China, Sta. 5321, *Alb.*; *b*, Philippines, Great Tobea I., *Alb.* (Scale=5 mm.)

Thalamita bouvieri Nobili

Thalamita bouvieri Nobili, 1906b, p. 262; 1907, pp. 384–385, pl. 2 (fig. 2).—Rathbun, 1911, p. 210.—Balss, 1938, p. 34.—Crosnier, 1962, pp. 119–121, figs. 201–204, pl. 10 (fig. 2).

Thalamita inhacae Barnard, 1950, p. 179, fig. 33g.—Stephenson and Hudson, 1957, pp. 337–339, figs. 2L, 3L, pls. 3 (fig. 2), 7H, 10E.—Stephenson, 1961a, p. 121.

MATERIAL.—Details of sex, size, and spinulation of the chelipeds are given with each specimen.

Australia: Dredged off Bottle and Glass Reef, 2 fm., Melbourne Ward, 1 female, 7 mm. (Right cheliped only present, with 2 spines, 1 spiniform tubercle, 1 indistinct tubercle.)

Marshalls: Eniwetok Lagoon, 3 mi. N. of Jieraru I., dredged 15–20 fm., June 5, 1946, Taylor, 1 ovig. female, 10 mm. (Both chelipeds with 2 spines, 1 spiniform tubercle, 2 tubercles.) Rongelap Lagoon 2 mi. W. of Busch I., 20 fm., June 21, 1946, Taylor, 1 male, 6 mm. (Both chelipeds with 3 spines, 2 tubercles.)

Samoa: Pago Pago, August 1902, *Alb.*, 1 female, 12 mm. (Left cheliped only present with 3 spines, 2 tubercles.)

REMARKS.—The above specimens are conspecific with material from both east and west Australia which was identified as *T. inhacae*

(Stephenson and Hudson, 1957; Stephenson, 1961a). In the single small male, the pleopod differs slightly from that figured in Stephenson and Hudson (1957) in possessing fewer subterminal bristles. On the inner side, only five stout spines are present, while on the outer side there are only five bristles, two of which are large.

Barnard's description of *T. inhacae* from Inhaca Bay in South Africa did not include comparison with *T. bouvieri*. The distinctions between the two species seem to be solely in the ornamentation of the hand of the cheliped. In *T. inhacae*, five blunt spines and one outer ridge are described by Barnard, while there are three spines and three ridges in *T. bouvieri*. Throughout the genus *Thalamita*, spines on the upper surface of the cheliped are invariably borne upon partial or complete carinae, and the presence of five spines necessarily implies more than one carina, with a suspicion of the usual two on the upper surface. These are certainly present in the Australian and present material. Spines are invariably subject to wear and capable of being reduced to obscure tubercles. Evidence of this is given in the details of the present collection.

Crosnier (1962) has examined female syntypes of *T. bouvieri* and provided the final confirmation of the synonymy.

DISTRIBUTION.—South Africa, Amirantes, Australia, Gilbert, and Tuamotou Is.

Thalamita chaptalii (Audouin)

Portunus chaptalii Audouin, 1826, p. 83 [figs. in Savigny, 1809, pl. 4 (fig. 1)].
Thalamita chaptalii (Audouin).—Alcock, 1899, pp. 80–81.
Thalamita chaptali (Audouin).—Stephenson and Hudson, 1957, pp. 327–328, figs. 2F, 3F, pls. 1 (fig. 3), 7C, 10B.—Forest and Guinot, 1961, p. 34, figs. 21A, B.—Sankarankutty, 1961a, p. 106.—Crosnier, 1962, pp. 111, 113, figs. 184, 189, 191.

MATERIAL.—Philippines: Tara I., Mindoro Strait, 130 ft. seine, Dec. 15, 1908, *Alb.*, 1 male, 1 female, 1 ovig. female; Mariveles, Luzon, June 27, 1913, A. M. Reese, 1 male.

Melanesia: Florida I., Solomon I., Oct. 28, 1944, Lt. R. E. Kuntz, 1 male, 1 female.

Marshalls: S–46–44, dredged 180–200 ft., Bikini Lagoon, Mar. 29, 1946, L. P. Schultz, 2 females.

MEASUREMENTS.—Males, 10–24 mm.; females, 10–18 mm.; ovig. female, 13 mm.

DISTRIBUTION.—Madagascar and Red Sea to Australia and Tahiti.

Thalamita coeruleipes Jacquinot

Thalamita coeruleipes Jacquinot, 1852, pl. 5 (figs. 6–10).—Jacquinot and Lucas, 1853, pp. 53–54.—Edmondson, 1954, pp. 265–267, figs. 38a–f, 39a.—Stephenson and Hudson, 1957, pp. 329–331, figs. 2P, 3P, pls. 2 (fig. 1), 7D, 9B.—

Forest and Guinot, 1961, pp. 32–33.—Crosnier, 1962, pp. 128–130, figs. 219 bis a–b, pl. 11 (fig. 2).

MATERIAL.—Philippines: Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″ N., 119°54′ E., Feb. 21, 1908, *Alb.*, 1 male, 1 female.

Australia: Great Barrier Reef, Apr. 8–May 29, 1952, John K. Howard, 1 male.

Marianas: Saipan I., in coral heads, 1945, A. H. Banner, 1 female; Aganta Bay, Guam, Sta. 85-x-44, May 20, 1945, R. H. Baker, 1 female; Agfayan Bay, Guam, 135/RHB 150, July 7, 1945, R. H. Baker, 1 female; Y259, Gillifitz, Yap I., sand, rocky coral covered reef, received 1952, Hiatt, 1 male.

Samoa: Apia, at mouth of river, June 1, 1902, *Alb.*, 2 females, 1 ovig. female; Apia, outer reef, June 27, 1902, *Alb.*, 2 males, 1 ovig. female; Apia, outer reef, June 27, 1902, *Alb.*, 1 juv; Apia, coral reef, July 1902, *Alb.*, 1 female; Apia, outer coral reef at low tide, July 1, 1902, *Alb.*, 2 males; Pago Pago, no. 10, August 1902, *Alb.*, 8 males, 2 females, 3 ovig. females; Pago Pago, August 1902, *Alb.*, 2 males.

Fanning Is.: Inner Lagoon, Fanning Is., Dec. 16, 1913, Fred and Charlotte Baker, 1 ovig. female.

Tuamotus and Societies: Sta. 84a–57 Huahine, head of Baie de Maroe, from branching coral, Apr. 30, 1957, Bredin Exped., 2 males.

MEASUREMENTS.—Males, 10–40 mm.; females, 18–53 mm.; ovig. females, 26–46 mm.

REMARKS.—The fourth anterolateral tooth is smaller than the fifth in small specimens, which hence key out as *T. prymna*. They are distinguished from *T. prymna* by the form of the front and inner orbital angles. In the Australian specimen the second of the normal anterolateral teeth is missing, and the first is greatly enlarged.

DISTRIBUTION.—Mauritius to Australia and Central Pacific Is.

Thalamita corrugata Stephenson and Rees

FIGURE 23

Thalamita cooperi Stephenson and Hudson, 1957, pp. 331–332, pls. 1 (fig. 4), 10C [in part, some specimens of *T. demani* Nobili, q.v.].

Thalamita corrugata Stephenson and Rees, 1961, pp. 421–425, figs. 1A, C, E, F, 2A–C.—Guinot, 1962, p. 9.

Not *Thalamita cooperi* Borradaile, 1902, pp. 206–207, fig. 37.—Sankarankutty, 1961a, p. 122, fig. 113.

MATERIAL.—Tuamotus and Societies: Sta. 10a–57, Tickahau Lagoon, Apr. 11, 1957, Bredin Exped., 2 males (6, 8 mm.), 2 females (5, 6 mm.).

REMARKS.—In general facies, the present material agrees in all respects with the females from Queensland, described by Stephenson and Hudson (1957) as *T. cooperi*.

The male pleopod and abdomen (figs. 23*a–c*) are described in Stephenson and Rees (1961, pp. 423–424). This pleopod shows considerable resemblances to that of *T. trilineata* Stephenson and Hudson (1957)(=*T. demani* Nobili), the differences being extra subterminal bristling on the outer side in *T. trilineata* where there is a relatively close packed elongate patch or double row. The species as a whole is close to *T. demani* but differs in the relatively narrower lateral frontal lobes (one-fifth instead of one-third breadth of the medians) and in the median cardiac ridge of the carapace being separated from the mesobranchials.

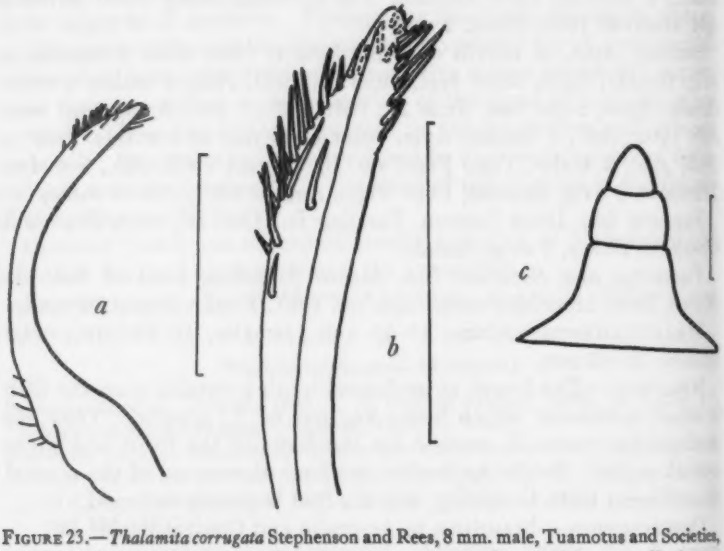

FIGURE 23.—*Thalamita corrugata* Stephenson and Rees, 8 mm. male, Tuamotus and Societies, Sta. 10a–57, Bredin: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.5 mm.; *c*, 1 mm.)

DISTRIBUTION.—Queensland and the Gilbert Is.

Thalamita crenata (Latreille)

Portunus crenatus Latreille, 1829, fide H. Milne Edwards, 1834, p. 461.

Thalamita crenata (Latreille).—Alcock, 1899, pp. 76–77.—Sakai, 1939, pp. 413–415, pl. 84 (fig. 3).—Edmondson, 1954, pp. 267–269, figs. 39b, 40a–f.—Stephenson and Hudson, 1957, pp. 332–334, figs. 2Q, 3Q, pls. 2 (fig. 3), 7F, 9C.—Sankarankutty, 1961a, pp. 106–107.—Crosnier, 1962, pp. 130–132, figs. 220, 226–227, 232–233.

MATERIAL.—Malay Penninsula: All from Siam: Taleui I., Sept. 27, 1923, 1 male (front damaged, median lobes confluent), 2 ovig. females; Koh Chang, Jan. 14, 1924, 1 dried male (left median and lateral

frontal lobes fused); Koh Chang, Apr. 5, 1924, H. M. Smith, 1 male; Koh Chang, west side of Gulf of Siam, July 15, 1926, 1 ovig. female; Hualap I., Sept. 26, 1926, H. M. Smith, 1 female; Sri Raja, Feb. 5, 1927, H. M. Smith, 1 male; Sri Raja, Feb. 5, 1927, 1 male, 1 female; Spiracha, southeastern Siam, rocks, May 6, 1929, 1 female; Gulf of Siam, Apr. 30, 1934, H. M. Smith, 1 female; Mayor Stream on north side of Goh Chang I., east side of Gulf of Siam, Oct. 28, 1957, Fehlmann, 1 female.

Philippines: Grand I., Subig Bay, Luzon, October 1907, Dr. J. C. Thompson, 1 female; Panabutan Bay, shore, Feb. 6, 1908, *Alb.*, 1 ovig. female; Tataan, Simaluc, shore, Feb. 19, 1908, *Alb.*, 1 male, Tataan Tawitawi, shore, Feb. 20, 1908, *Alb.*, 2 males; Borrgoa I., Tawitawi, shore, Feb. 23, 1908, *Alb.*, 1 male, 1 ovig. female; Sandakan, Borneo, seine, Mar. 2, 1908, *Alb.*, 6 females; Jolo, Jolo I., shore, Mar. 6, 1908, *Alb.*, 1 male; reefs opposite Cebu, Apr. 7, 1908, *Alb.*, 1 male; east side Tagbilaran Strait, Bohol I., shore, Apr. 9, 1908, *Alb.*, 4 males, 5 females; San Miguel Harbor, Ticao I., between Burias and Luzon Is., Apr. 21, 1908, *Alb.*, 1 fragmented male; shore about Iloilo River, 130 ft. seine, June 2, 1908, *Alb.*, 2 males, 1 female; Point Jarnelo, Luzon River, 150 ft. seine, July 13, 1908, *Alb.*, 1 male, 2 females; Sta. 5292, July 23, 1908, *Alb.*, 1 male, 1 female; Port San Pio, in small stream near mouth, 20 ft. seine, Nov. 11, 1908, *Alb.*, 1 male; Luzon shore, San Vicente Harbor, seine, Nov. 11, 1908, *Alb.*, 1 male; Luzon shore, San Vicente Harbor, seine, mud, sand, sticks, and leaves, Nov. 13, 1908, *Alb.*, 1 male, 1 female; Port Uson, W. of Pinas I., electric light, Dec. 17, 1908, *Alb.*, 2 males; Nakochin Harbor, Linapacan I., seine, Dec. 19, 1908, *Alb.*, 1 male, 1 female; Ulugan Bay, near mouth of Caiholo River, Palawan I., seine, Dec. 28, 1908, *Alb.*, 1 male, 1 female; Buena Vista, Guimaras I., Iloilo Strait, seine in mouth of river, Jan. 14, 1909, *Alb.*, 1 male; Alimango River, Burias I., Mar. 5, 1909, *Alb.*, 1 male (*Sacculina* infected), 1 female; San Pascual, Burias I., tide pool, Mar. 8, 1909, *Alb.*, 1 female; Caumahala Bay, Ragay Gulf, mouth of small stream, Mar. 11, 1909, *Alb.*, 1 male (front damaged), 4 ovig females; Cebu Market, Mar. 26, 1909, *Alb.*, 1 male; Cuyo I., 130 ft. seine, Apr. 9, 1909, *Alb.*, 1 male, 1 female; Nato River, east coast Luzon, San Bernadino Strait to San Miguel Bay, June 18, 1909, *Alb.*, 1 female; Fishermen Makinog, Camiguin I., between Leyte and Mindanao I., tide pool, Aug. 3, 1909, *Alb.*, 1 female; Labuan Blanda I., Dec. 14, 1909, *Alb.*, 2 males, 3 females (2 ovig.); Great Tobea I., tide pool, sand, coral, Dec. 15, 1909, *Alb.*, 1 male; Iloilo, Panay I., Apr. 6, 1929, H. C. Kellers, 1 female; Jolo, Sulu, mud, sand, sticks, and leaves, July 13–19, 1929, Herre collection; 1 male, 1 female (Philippine Is.; E. A. Mearns, 3 males, 2 females).

Australia: Little Lagoon and vicinity northeastern end of Groote Eylandt, Gulf of Carpentaria, 1948, R. R. Miller, 1 fragmented male; Yirrkala, 1948, Arnhem Land Exped., 2 fragmented males; Umba Kumba, south side of Little Lagoon, northeastern end Groote Eylandt, Gulf of Carpentaria, taken between Apr. 6 and May 18, 1948, R. R. Miller, 1 male, 1 female; Ironstone Reef at Rocky Beach ± 3 mi. S. of the point E. of Yirrkala and NW. of Cape Arnhem, N.T., July 18, 1948, R. R. Miller and F. M. Setzler, 1 male, 1 female (soft and fragmented).

Palau Is.: GVF, High I., Atoll Project, Sta. 12, 1955, H. A. Fehlmann, S. Pierce, R. Harry, 2 males; GVF, High Atoll Project, Sta. 60, W. of Ebadul's Pier, north end of Koror I., sand and eel grass flat, 1011—Crustacea, Aug. 5, 1955, Fehlmann and Harry, 1 male.

Marianas: Ajayan River, Guam, 112X–65, June 19, 1945, D. H. Johnson, 1 male, 2 females; Oca Point, Guam (Alupat I.), July 5, 1945, L. P. McElroy, 1 female; Y114A, from under stones in holes in dead coral blocks, intertidal zone, Tomil Harbor, received June 23, 1952, 2 males, 2 females, 7 juvs.

Samoan Is.: Apia, outer reef, June 22, 1902, *Alb.*, 1 fragmented male; Apia, holes along Vailele River above tidewater, July 1902, *Alb.*, 1 juv; Pago Pago, no. 10, August 1902, *Alb.*, 1 male.

Tuamotus and Societies: Sta. 26–57, Maiai I., Tikahau Atoll, lagoon side, off beach, Apr. 13, 1957, Bredin Exped., 4 males; Sta. 27, Maiai I., Tikahau Atoll, Tuamotu Is., lagoon side, along shore, seining marly clay bottom, Apr. 14, 1957, Bredin Exped., 1 female.

Measurements.—Males, 17–91 mm.; females, 19–63 mm.; ovig. females, 40–63 mm.; juvs., 8–16 mm.

Remarks.—In juveniles narrower than 10 mm., the fourth anterolateral tooth is smaller than the fifth, and the specimens key out in the wrong direction at couplet 3 in Stephenson and Hudson (1957, p. 316).

In the males "89 mm. Port Uson, West of Pinos I., Dec. 17, 1908, *Alb.*," and "91 mm. Cebu market, Mar. 26, 1909, *Alb.*," the mesogastric ridges are concave anteriorly instead of being straight, and the basal antennal joint is more crestlike than usual. Possibly these features are related to size, these being the largest specimens so far examined by the senior author.

The single *Sacculina* infected male "34 mm, Alimango River, Burias I., Mar. 5, 1909; *Alb.*," in addition to having the characteristically broader abdomen, has an unusually convex carapace.

The male "47 mm, Koh Chang, Siam, Jan. 14, 1924," has the submedian and lateral frontal lobes fused on the left side.

A male "60 mm, Sta. 26–57, Maiai I., Apr. 13, 1957," is abnormal in possessing a small additional frontal lobe between the lateral frontal lobe and the supraorbital angle on the left side.

The right pleopod of a male "67 mm, G.V.F., High I. Atoll Project, Sta. 12; 1955" is grossly malformed, and bears what is probably a crustacean parasite.

DISTRIBUTION.—Durban and Red Sea to Japan, Australia, Hawaii, and Society Is., and now Tuamotus.

Thalamita dakini Montgomery

FIGURE 24

Thalamita dakini Montgomery, 1931, pp. 432–433, pls. 23 (fig. 3), 28 (fig. 4).—Stephenson and Hudson, 1957, pp. 334–335.—Stephenson, 1961a, pp. 118–119, figs. 2D, 3J, pls. 3 (fig. 3), 4I, 5F.
Thalamita medipacifica Edmondson, 1954, pp. 260–262, figs. 34a,b, 35a.

MATERIAL.—Marianas: Ritidian Point, Guam, Sta. 148–R.H.B. 155, July 12, 1945, Baker, 1 male, 1 ovig. female.

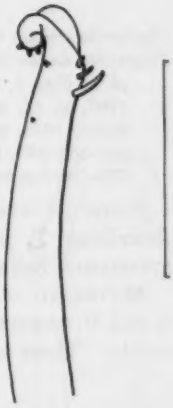

FIGURE 24.—*Thalamita dakini* Montgomery, male, Hawaii, Waikiki Marine Lab., Mar. 28, 1942, Mansfield: pleopod tip, upper surface. (Scale=0.5 mm.)

Gilbert Is.: Howland I., 1926, C. H. Edmondson, 1 male, 1 ovig. female.

Hawaii: Black Point, Haunama Bay, Oahu, 1937, L. R. Woodward, S. F. Light, 1 female, 1 ovig. female, 1 juv; Waikiki Marine Lab., Honolulu, Mar. 28, 1942, G. S. Mansfield, 1 male; coast near Kawailoa, Oahu, under growth of coralline algae, Apr. 4, 1942, G. S. Mansfield, 3 females (2 ovig.); Waikiki Marine Lab. from coral, Apr. 24, 1942, 5 males, 1 ovig. female, 1 juv.

Tuamotus and Societies: Society Is., summer 1925, J. M. Clements, 1 male, 1 ovig. female; Bora Bora, inner edge of outer reef, Sta. 62–57, 2 males, 3 females (2 ovig.), 1 juv; Nuarei Bay, Moorea, Sta. 127–57

coral in shallow, sandy beach, May 11, 1957, Bredin Exped., 1 male, 1 ovig. female.

MEASUREMENTS.—Males, 7–28 mm.; females, 10–15 mm.; ovig. females, 10–21 mm.; juv., 6 mm.

REMARKS.—In previous papers (Stephenson and Hudson, 1957; Stephenson, 1961a) Edmondson's species was included as a queried synonym. Doubt arose from minor differences between the male pleopod as figured by Edmondson (1954, figs. 34g, h) and those of the single male available from Australia. Edmondson showed two terminal spinules on the inner surface, which had no counterpart in the Australian specimen, and five instead of three subterminal spinules on the outer surface.

The present material shows variability in armature of male pleopods (see table 2, p. 114).

DISTRIBUTION.—Western Australia and Hawaii (Edmondson, 1954; Stephenson, 1961a).

Thalamita danae Stimpson

FIGURES 25*a–e*, 26*a–c*

Thalamita crenata Dana, 1852a, pp. 282–283, pl. 17 (figs. 7a,b) (not Latreille, 1829).
Thalamita danae Stimpson, 1858, p. 37.—A. Milne Edwards, 1861, pp. 366–367, pl. 36 (figs. 1, 1a–c).—de Man, 1902, pp. 644–645, pl. 21 (fig. 28).—Stimpson, 1907, p. 85, pl. 11 (figs. 1,1a).—Shen, 1934, pp. 52–53, figs. 15, 16a–c.—Sakai, 1939, pp. 413, 415, pl. 85 (fig. 3).—Stephenson and Hudson, 1957, pp. 335–337, figs. 2N, 3N, pls. 3 (fig. 1), 7G, 10D.—Crosnier, 1962, pp. 135–136 (under *T. foresti*), figs. 228, 232–233.

NOTE ON SYNONYMY AND NOMENCLATURE.—Crosnier (1962), in describing *T. foresti*, revised the synonymy of *T. danae*. To his synonymy, Sakai (1939) is now added.

MATERIAL.—Two forms are recognized in adult males, called forms A and B, respectively, distinction being by male abdomens and pleopods. These are listed separately as are females and juveniles.

MALES (FORM A)

Malay Peninsula: Hualap I., Siam, Sept. 26, 1926, H. M. Smith, 1 male.

Philippines: Guijulugan, Negros, shore, seine, Apr. 2, 1908, *Alb.*, 1 male; reefs opposite Cebu, Apr. 7, 1908, *Alb.*, 2 males; Dumurug Point, Masbate, shore, Apr. 19, 1908, *Alb.*, 8 males (1 *Sacculina* infected, 1 with broad abdomen); Busin Harbor, Burias I., between Burias and Luzon, Apr. 23, 1908, *Alb.*, 1 male; Little Santa Cruz I., Zamboanga, Mindanao, soft coral, marginal reefs, May 26, 1908, *Alb.*, 1 male; Masinloc Bay, Tacubales Province, Nov. 22, 1908, *Alb.*, 1 male; Caumahala Bay, Ragay Gulf, mouth small stream, Mar. 11, 1909, *Alb.*, 1 male; Canino I., near Daet, June 15, 1909, *Alb.*, 1 male;

Batan I., July 22, 1909, *Alb.*, 2 males; near Mariveles, Luzon, 1913, Albert M. Reese, 1 male; mangrove swamp, Zamboanga, Mindanao, Mar. 8, 1914, F. Baker, 1 male.

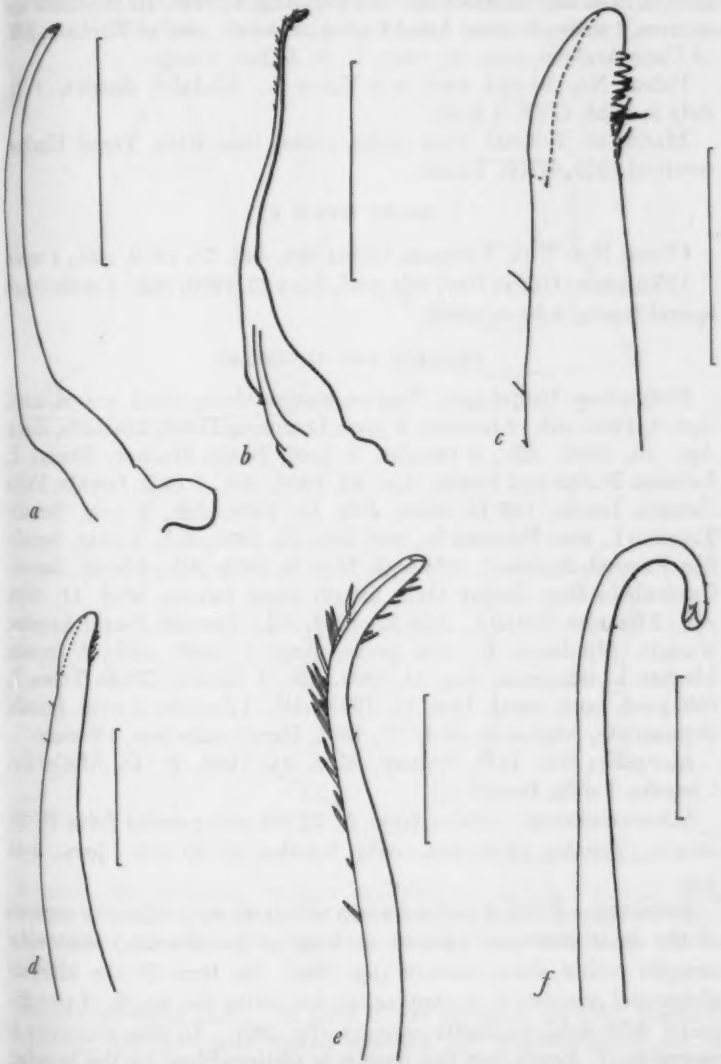

FIGURE 25.—Male pleopods and tips. *Thalamita danae* Stimpson: *a*, *c*, *d*, form A, Philippines, Dumurug Pt., *Alb.*; *b*, *e*, form B, China, Nau Wau, *Alb.* *T. foresti* Crosnier: *f*, China, Sabtan I., *Alb.* (Scales=*a*, *b*, 5 mm.; *c*, 0.5 mm.; *d*–*f*, 1 mm.)

Australia: Sta. 11B, Sydney, Mar. 21, 1948, F. D. McCarthy, 1 male; reef at Yirrkala, July 12, 1948, R. R. Miller, 1 male; ironstone reefs (not coral) and rock pools at Yirrkala, NW. of Cape Arnhem, part of M48–21, emulsifiable rotenone, Aug. 6, 1948, R. R. Miller and natives, 1 male; Arnhem Land Exped., M48–21, reef at Yirrkala, NW. of Cape Arnhem, Aug. 12, 1948, R. R. Miller, 1 male.

Palau: No. 10–814 west end Koror I., Madalai district, 1 ft., July 8, 1955, GVF, 1 male.

Marianas: Y–128G from under rocks, tidal flats, Tomil Harbor, received 1952, Hiatt, 1 male.

MALES (FORM B)

China: Nau Wau, Formosa, China Sea, Jan. 27, 1910, *Alb.*, 1 male.

Philippines: Gubat Bay, tide pool, June 23, 1909, *Alb.*, 1 male (right lateral frontal lobe missing).

FEMALES AND JUVENILES

Philippines: Guijulugan, Negros, station shore, sand, gravel, mud, Apr. 2, 1908, *Alb.*, 2 females, 9 juvs; Dumurug Point, Masbate, shore, Apr. 19, 1908, *Alb.*, 6 females, 2 juvs; Busin Harbor, Burias I., between Burias and Luzon, Apr. 23, 1908, *Alb.*, 1 ovig. female; Point Jarnelo, Luzon, 150 ft. seine, July 13, 1908, *Alb.*, 1 ovig. female; Tivanao I., near Palawan Is., reef, Dec. 31, 1908, *Alb.*, 1 ovig. female; San Pascual, Burias I., tide pool, Mar. 8, 1909, *Alb.*, 1 ovig. female; Caumahala Bay, Ragay Gulf, mouth small stream, Mar. 11, 1909, *Alb.*, 2 females; Batan I., July 22, 1909, *Alb.*, 1 female, 3 ovig. females; Nasigit, Mindanao I., tide pools, Aug. 1, 1909, *Alb.*, 1 female; Mactan I., tide pools, Aug. 31, 1909, *Alb.*, 1 female; Great Tobea I., tide pool, sand, coral, Dec. 15, 1909, *Alb.*, 1 female, 1 ovig. female; Dumaguete, Negros Is., July 11, 1931, Herre collection, 1 female.

Australia: Sta. 11B, Sydney, Mar. 21, 1948, F. D. McCarthy, 1 female, 1 ovig. female.

MEASUREMENTS.—Males form A, 22–73 mm.; males form B, 36, 46 mm.; females, 18–53 mm.; ovig. females, 42–56 mm.; juvs., 9–18 mm.

REMARKS.—Form A males have a relatively long ultimate segment of the male abdomen (almost as long as penultimate) with sides straight rather than concave (fig. 26*a*). In form B the ultimate abdominal segment is shorter (about four-fifths the length of penultimate) with sides markedly concave (fig. 26*c*). In this concavity it resembles *T. foresti*, but this species is distinguished by the broader, distally swollen penultimate segment, and the more elongate ultimate segment (fig. 26*d*).

The pleopods of form A males are relatively stout and end abruptly (figs. 25*a*, *c*, *d*). Subterminally on the outer side there are approximately six very short, stout, tubercle-like, laterally directed spines, overlapped and succeeded by about six bristles which are mostly forwardly directed. Subterminally on the inner side there are a few

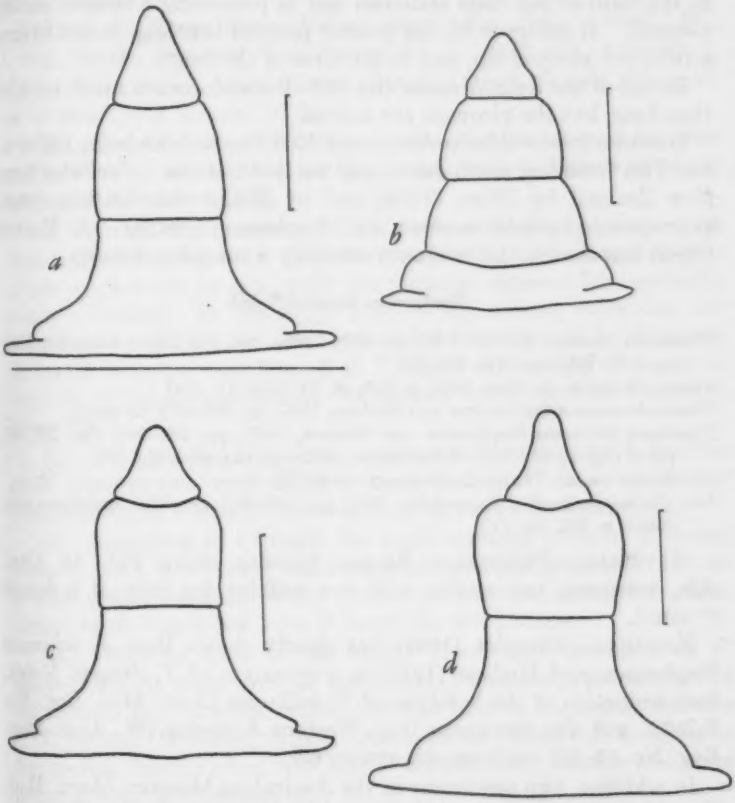

FIGURE 26.—Male abdomens. *Thalamita danae* Stimpson: *a*, form A (normal), Philippines, Dumurug Pt., *Alb.*; *b*, form A (abnormal), Philippines, Dumurug Pt., *Alb.*; *c*, form B, China, Nau Wau, *Alb.* *T. foresti* Crosnier: *d*, China, Sabtan I., *Alb.* (Scale= 5 mm.)

sparsely arranged hairs. In form B, the pleopods are thin, gradually tapering, and distinctly curved near the tip. Subterminally on the outer side there are about six stout, elongate, forwardly directed bristles. On the inner side there is an extended row of elongate, forwardly directed spines.

The pleopods of form B differ markedly from those of form A and related species such as *T. coeruleipes*, *T. crenata*, *T. prymna*, and *T. stimpsoni*. But for the similarity in general facies, it would have been placed in a different "group" within the genus (see Stephenson and Hudson, 1957, pp. 320, 362). Form B is very close to *T. foresti* in the form of the male abdomen and in possessing a slender curved pleopod. It differs in having stouter pleopod bristling, in not having a recurved pleopod tip, and in the form of the front.

In one of the form A males (fig. 26*b*) the abdomen is much broader than long, but the pleopods are normal.

DISTRIBUTION.—Mozambique and Red Sea to Marshalls, Gilberts, and Fiji, including south Japan and north Australia. Recorded from New Zealand by Miers (1876) and by Heller (fide Doflein, 1904) and repeated by later workers, e.g., Stephenson (1961b). As Hutton (1882) has shown, this is almost certainly a mistaken locality.

Thalamita demani Nobili

Thalamita demani Nobili, 1905, p. 402; 1906a, pp. 209–210.—Crosnier, 1962, pp. 124–125, figs. 200, 208–209.
Thalamita invicta de Man, 1895, p. 565, pl. 13, (figs. 11, 11a).
Thalamita cooperi Stephenson and Hudson, 1957, pp. 331–332 (in part).
Thalamita trilineata Stephenson and Hudson, 1957, pp. 359–360, figs. 2E, 3E, pls. 6 (fig. 4), 8S, 10L.—Stephenson, 1961a, p. 124, pl. 4 (fig. 2L).
?*Thalamita invicta* Thallwitz, 1891, pp. 46–47, fig. 11.
Not *Thalamita cooperi* Borradaile, 1902, pp. 206–207, fig. 37.—Sankarankutty, 1961a, p. 122, fig. 113.

MATERIAL.—*Philippines:* Bataan, Simaluc, shore, Feb. 19, 1908, *Alb.*, carapace, two chelae, and one walking leg only of a female (7 mm.).

REMARKS.—Crosnier (1962) has clearly shown that *T. trilineata* Stephenson and Hudson (1957) is a synonym of *T. demani* Nobili. Reexamination of the holotype of *T. trilineata* (Aust. Mus. Reg. No. P.2863) and also specimens from Western Australia (W. Aust. Mus. Reg. No. 84–60) confirms this synonymy.

In addition, two specimens in the Australian Museum (Aust. Mus. Reg. Nos. P.7546 (9 mm. female) and P.12754) reported as *T. cooperi* by Stephenson and Hudson (1957, pp. 331–332) belong to this species, as does a third (Aust. Mus. Reg. No. P.7546, 10 mm. female).

DISTRIBUTION.—Red Sea, Madagascar, and both east and west Australia.

Thalamita foresti Crosnier

FIGURES 25*f*, 26*d*

Thalamita danae de Man, 1887b, pp. 78–79, pl. 4 (figs. 8, 9).
Thalamita foresti Crosnier, 1962, pp. 132–136, figs. 221–223, 229–231, pl. 13 (fig. 1).

?*Thalamita danae* Alcock, 1889, pp. 77–78.—Barnard, 1950, p. 174.
Not *Thalamita danae* Stimpson, 1858, p. 39.

MATERIAL.—Malay Peninsula: Koh Pipedon, Pocket Bay, Benjal, Siam, Mar. 10, 1925, Hugh M. Smith, 1 female.

China: Sabtan I., China Sea, vicinity Hong Kong, Nov. 8, 1908, *Alb.*, 1 male.

Philippines: Nogas Point, Panay, shore seine, Feb. 4, 1908, *Alb.*, 1 ovig. female; base reef, Gulf Boni, Dec. 17, 1909, *Alb.*, 1 female.

MEASUREMENTS.—Male, 41 mm.; female, 56 mm.; female, damaged, ca. 37 mm.; ovig. female, 36 mm.

REMARKS.—Crosnier (1962) distinguishes this species from the very similar *T. danae* on the basis partly of adult male features and partly on general facies as follows:

a. Penultimate segment of the male abdomen is much wider than long, diverging in its proximal two-thirds, then narrowing conspicuously toward its end, while the ultimate segment has markedly concave borders. In the single male in the present collection, the penultimate segment (fig. 26*d*) is broader than figured by Crosnier. It should be noted that form B of *T. danae* approaches *T. foresti* in the form of the male abdomen. (Compare figure 26c with Crosnier's figure 223.)

b. Male pleopod is elongate, tapering with a recurved tip bearing small spinules and very different from that of *T. danae* (form A). However, forms A and B of *T. danae* differ markedly themselves.

c. According to Crosnier the basal antennal joint in *T. foresti* bears a more prominent crest carrying sharper granules. In the present collection of *T. danae* (form A), there are specimens which cannot be distinguished from *T. foresti* on this feature.

d. Different form of the front. Here again examples of *T. danae* (form A) show some of the points, for example prominence of the median frontal lobes, which Crosnier lists as diagnostic features of *T. foresti*. However, typical specimens do differ, and in all cases the median frontal lobes in *T. foresti* are relatively smaller and more rounded than in *T. danae*.

A further small distinction lies in the infraorbital lobe which is more ventrally inclined in *T. foresti*, the difference being most obvious in ventral view.

DISTRIBUTION.—Previously Madagascar and possibly Andaman I. and Mozambique.

Thalamita gatavakensis Nobili

Thalamita pilumnoides var. *gatavakensis* Nobili, 1906b, p. 262; 1917, p. 384.
Thalamita pilumnoides gatavakensis Nobili.—Forest and Guinot, 1961, pp. 34–36, figs. 23–25.

Thalamita gatavakensis Nobili.—Crosnier, 1962, pp. 106–108, figs. 156 bis a–c, e, 177 bis a–b.

Thalamita granosimana Stephenson, 1961a, pp. 119–121, figs. 2E, 4A, pls. 4J, 5G [not *Thalamita granosimana* Borradaile].

MATERIAL.—Philippines: Sta. 5165, Observation I., Sulu Archipelago, Tawitawi Group, 4°58′20″N., 119°50′30″E., 9 fm., coral, Feb. 24, 1908, *Alb.*, 3 males.

Tuamotus and Societies: Sta. 3–57, Papeete Harbor, Tahiti, anchor chain, Apr. 8, 1957, Bredin Exped., 3 males, 2 females, 2 ovig. females; Sta. 62–57, Bora Bora, inner edge of outer reef, Apr. 25, 1957, Bredin Exped., 3 males.

MEASUREMENTS.—Males, 4–8 mm.; females, 7, 8 mm.; ovig. females, 9, 13 mm.

REMARKS.—The present material greatly resembles that described by Forest and Guinot, including Nobili's, from the Tuamotus. The only differences are that the mesobranchial ridges of the carapace are more distantly separated from the median cardiac, the mesogastric are less interrupted in the midline, and the dactyl of the walking legs is slightly shorter than the propodus.

Minor differences also existed between Crosnier's single specimen and Nobili's type, and between Nobili's syntypes (see Crosnier, 1962, fig. 156 bis a–c, e).

None of the males bore pleopods; these were smaller than the lectotype figured by Forest and Guinot.

Distinctions from *T. pilumnoides* Borradaile are given under that species; a fuller description of the present species, albeit misidentified, is given in Stephenson (1961a).

DISTRIBUTION.—Madagascar, Western Australia, and Tuamotus.

Thalamita gloriensis Crosnier

Thalamita gloriensis Crosnier, 1962, pp. 98–100, 102–103, figs. 155, 156 bis d, 159–160, 165–167, 169.

MATERIAL.—Melanesia: No. 4, Bougainville, Jan. 10, 1945, W. Bartos, 1 ovig. female (10 mm.).

Marianas: Saipan, in coral heads, 1945, A. H. Banner, 1 male (6 mm.).

Marshalls: East Rigili I., Eniwetok Atoll, rock flats, May 30, 1946, J. P. E. Morrison, 1 ovig. female (18 mm.).

Hawaii: Waikiki Marine Lab., from seaweed, Feb. 1, 1942, G. S. Mansfield, 1 juv. (4 mm.).

Tuamotus and Societies: Huahine, off Point Teffaao Sta. 90a–57, May 2, 1957, Bredin Exped., 1 ovig. female (6 mm.).

REMARKS.—Only the following minor differences with Crosnier's description were noted:

a. Marshall Is. specimen, 3rd anterolateral tooth not much smaller than the other teeth.

b. Above plus Huahine specimen, one or two well-developed spines on wrist behind that at the articulation; wrist more spiniform than in Crosnier's figure 165.

DISTRIBUTION.—Previously only from Glorious Is., Madagascar.

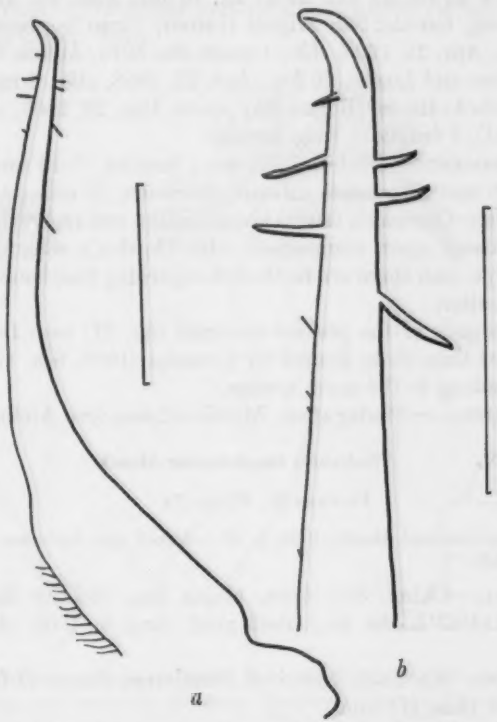

FIGURE 27.—*Thalamita granosimana* Borradaile, male, Philippines, Caiholo R., *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface. (Scales=*a*, 1 mm.; *b*, 0.5 mm.)

Thalamita granosimana Borradaile

FIGURE 27

Thalamita granosimana Borradaile, 1902, pp. 202–203.—Crosnier, 1962, pp. 103–106, figs. 171–172, 175–177, pls. 8 (fig. 2), 13 (fig. 3).

Not *Thalamita granosimana* Stephenson, 1961a, pp. 119–121, figs. 2E, 4A, pls. 3 (fig. 4), 4J, 5G (= *Thalamita gatavakensis* Nobili).

MATERIAL.—Philippines: Sta. 5158, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′N., 119°54′30″E., 12 fm., Feb. 21, 1908, *Alb.*,

2 males; Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 10 males, 6 females, 4 ovig., females, 1 *Sacculina* infected specimen; Sta. 5160, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′40″N., 119°55′10″E., 12 fm., sand, Feb. 22, 1908, *Alb.*, 1 female, 3 ovig. females; Tomindao I., anchorage, electric light, Feb. 26, 1908, *Alb.*, 1 female; Sta. 5169, Sibutu I., 4°32′15″N., 119°22′45″E., 10 fm., Feb. 27, 1908, *Alb.*, 3 males, 1 ovig. female; San Miguel Harbor, Ticao Is., between Burias and Luzon, Apr. 21, 1908, *Alb.*, 1 male; Sta 5218, Anima Solo Is., between Burias and Luzon, 20 fm., Apr. 22, 1908, *Alb.*, 2 males, 1 ovig. female; Caiholo River, Ulugan Bay, seine, Dec. 29, 1908, *Alb.*, 4 males (1 damaged), 1 female, 1 ovig. female.

MEASUREMENTS.—Males, 8–24 mm.; females, 7–16 mm.; ovig. females, 9–18 mm.; *Sacculina* infected specimen, 13 mm.

REMARKS.—Crosnier's (1962) identification and redescription of this species is based upon comparison with Gordon's refiguring of Borradaile's type, and there are no doubts regarding Stephenson's (1961a) misidentification.

Male pleopods of the present material (fig. 27) bear fewer subterminal spines than those figured by Crosnier (1962, figs. 175–177) but evidently belong to the same species.

DISTRIBUTION.—Madagascar, Maldive-Laccadive Archipelago.

Thalamita imparimana Alcock

FIGURES 28; PLATE 7A

Thalamita imparimanus Alcock, 1899, p. 87.—Alcock and Anderson, 1900, pl. 47 (figs. 3,3a).

MATERIAL.—China: Sta. 5304, China Sea, vicinity Hong Kong, 21°46′N., 114°47′E., 34 fm., black mud, Aug. 9, 1908, *Alb.*, 1 male (8 mm.).

Philippines: Sta. 5131, Island off Panabutan Point, 27 fm., Feb. 6, 1908, *Alb.*, 1 male (11 mm.).

REMARKS.—Alcock's brief diagnosis serves to identify this species. It resembles *T. investigatoris* in its long walking legs and in the form of the chelipeds. In these the upper surface bears rounded granules; there are no carinae, and only two spines are present on the upper surface (including the one at the wrist articulation). The species is characterized by the considerable overlap between median and submedian frontal lobes and by the absence of spinules on the posterior borders of the propodite of the fifth leg.

The male abdomen and pleopod appear not to have been described; both are highly characteristic. Penultimate segment of abdomen with markedly convex lateral borders (fig. 28*c*). Pleopod with re-

markable double curvature: tip flared and swollen, surmounted with a crest of long bristles; overall resembling a crested crane. Beyond basal lobes outer surface bare until just behind tip, here a single row of short hairs. Conspicuous crest on inner surface (which because of curvature becomes directed anteriorly) consisting of single row of about 30 elongate spines merging distally with about 15 short bristles. Tip of appendage bearing four stout bristles.

DISTRIBUTION.—Previously apparently only from Alcock's material from Ganjan Coast, India.

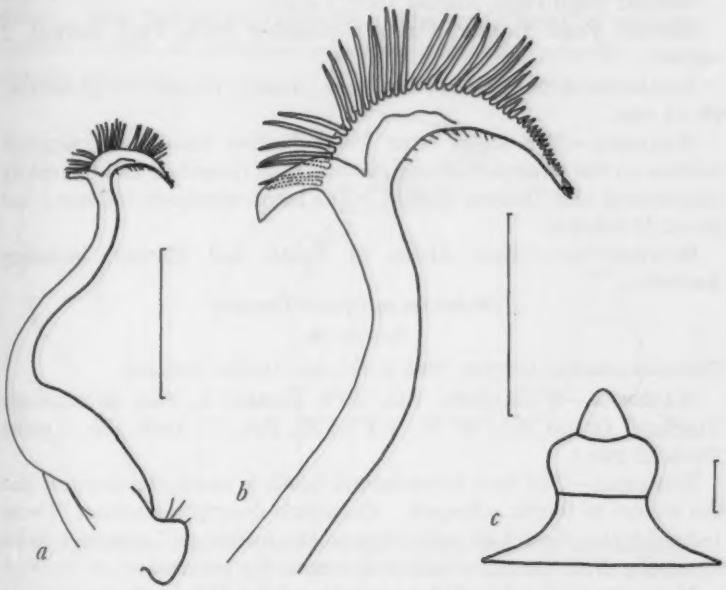

FIGURE 28.—*Thalamita imparimana* Alcock, male, Philippines, Sta. 5131, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.5 mm.; *c*, 1 mm.)

Thalamita integra Dana

Thalamita integra Dana, 1852b, p. 85.—Alcock, 1899, p. 85.—Sakai, 1939, pp. 414, 420–421, fig. 15, pl. 84 (fig. 2).—Edmondson, 1954, pp. 252, 253–254, figs. 27a–e, 28a.—Stephenson and Hudson, 1957, pp. 339–341, figs. 2H, 3H, pls. 3 (fig. 3), 7I, 10F.—Sankarankutty, 1961a, p. 105; 1961b, p. 122.—Crosnier, 1962, p. 103, figs. 156, 161, 170.

MATERIAL.—Philippines: *Alb.*, 1 female (no further data); Sta. 5169, Sibutu I., 4°32′15N″., 119°22′45″E., 10 fm., Feb. 27, 1908, *Alb.*, 1 male; Romblon, 150 ft. seine, Mar. 26, 1908, *Alb.*, 1 ovig. female; Tilig, Lubang, beach, July 14, 1908, *Alb.*, 1 ovig. female;

San Pascual, Burias I., tide pool with copper sulphate, Mar. 8, 1909, *Alb.*, 2 males.

Palau Is.: Sta. 12–832, Madalai district, west end Koror I., mangrove shore grading into mud and sand flat, July 9, 1955, GVF, 2 males.

Marianas: Sta. 96/x–49, Oca Point, Guam, June 26, 1945, D. H. Johnson, 2 males.

Japan: Okinawa, received Oct. 22, 1945, Maj. Wm. Thomas, 1 male.

Samoa: Pago Pago, August 1902, 1 male.

Hawaii: Pearl Harbor, Oahu, September 1920, Paul Bartsch, 2 males.

MEASUREMENTS.—Males, 8–32 mm.; female, 18 mm.; ovig. females, 16–24 mm.

REMARKS.—The males from Pearl Harbor have more terminal bristles on the outer side of the pleopod than described and figured by Stephenson and Hudson (1957). The larger specimen (32 mm.) has about 18 bristles.

DISTRIBUTION.—East Africa to Tahiti and Hawaii, including Australia.

Thalamita mitsiensis Crosnier

FIGURE 29

Thalamita mitsiensis Crosnier, 1962, p. 127, figs. 212–213, 216–218.

MATERIAL.—Philippines: Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 2 males (both 12 mm.).

REMARKS.—The first anterolateral tooth is much the stoutest and the second to fourth subequal. Crosnier's description states, "Dents 1–3 subégales, dent 4 de taille légerèment inférieure," although in his figure (fig. 212) the first tooth is shown as the stoutest.

The posterior border of the propodus of the fifth leg bears seven to eight spines, not six.

DISTRIBUTION.—Previously only from Mitsio Is., Madagascar.

Thalamita multispinosa, new species

PLATE 7B

MATERIAL.—Hawaii: Off Waikiki Marine Lab., Honolulu, Apr. 30, 1942, G. S. Mansfield, 1 female (21 mm., holotype, cat no. 112206).

DESCRIPTION: Front: 6-lobed, protruding slightly beyond supraorbital angles. Median lobes rounded, deeply separated from each other and from the intermediates which are about 1½ times their breadth. Lateral frontal lobes small with shallow separation from intermediates. Supraorbital angles short, sharply arched. Two conspicuous indentations in upper border of orbit.

Anterolateral teeth: Five. First stoutest and bluntest, remainder sharp with fourth the smallest.

Carapace: Relatively long (B/L=1.3), covered with fine pile through which coarsely granular ridges are evident. Frontals, small elevated granular patches; protogastrics curved, slightly irregular; mesogastrics concave anteriorly, distinctly separated. Conspicuous patches opposite second and fourth anterolateral teeth. Epibranchials smoothly curving, terminating abruptly with small coarsely granular subterminal patch. Short continuous metagastric. Two broadly separated cardiacs. One pair of mesobranchials slightly in front of cardiacs. Posterior border of carapace apparently smooth, actually microscopically granular.

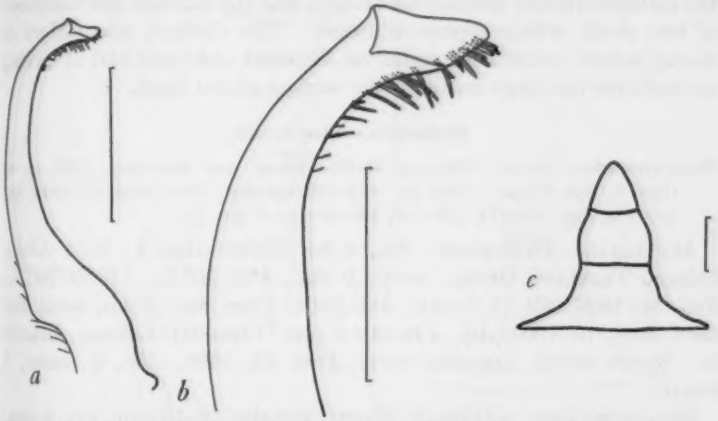

FIGURE 29.—*Thalamita mitsiensis* Crosnier, male, Philippines, Sta. 5159, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.5 mm.; *c*, 1 mm.)

Basal antennal joint: Shorter than width of orbit (0.8 times) and bearing short, steeply elevated crest, covered with small, rounded, close-packed granules.

Chelipeds: Left only present. Spinous, coarsely granular, and hirsute with squamiform markings on under surface of hand. Anterior border of arm with two long distal spines and shorter proximal spine. Wrist with three usual spines on outer surface and longer than usual spine at inner surface. Outer border of hand with two distinct coarsely granular carinae. Upper surface bearing four sharp spines excluding that at wrist articulation, and without obvious carinae. Inner surface with central carina granular, remainder coarsely granular. Fingers long, sharp, strongly carinated.

Fifth leg: Merus about twice as long as broad, with usual subterminal spine on hinder surface; posterodistal border also spinous. Propodus with very numerous small spines (ca. 20).

REMARKS.—This specimen keys out in Stephenson and Hudson (1957) as *T. picta*; however, it is neither *T. picta*, the related *T. wakensis*, nor *T. philippinensis*. It differs in the very large number of spines on the posterior border of the propodus of the fifth leg, hence the specific name.

It is probably closest to *T. picta* but differs in the more rounded frontal and inner orbital lobes and in various details of the carapace ridging. The protogastric ridges are shorter than in *T. picta*, the mesogastrics are more distinctly interrupted in the midline and are concave anteriorly. There is a broader interruption between the the metagastric and epibranchial ridges, and the cardiacs are composed of two short, widely separated ridges. The cheliped also differs in having longer and sharper spines on the wrist and hand and in having squamiform markings on the under surface of the hand.

Thalamita oculea Alcock

Thalamita oculea Alcock, 1899, pp. 91–92.—Alcock and Anderson, 1900, pl. 48 (figs. 3, 3a).—Sakai, 1939, pp. 424–425, text-fig., 18.—Crosnier, 1962, pp. 109–111, figs. 173–174, 178–180, 193–194, pl. 9 (fig. 1).

MATERIAL.—Philippines: Sta. 5165, Observation I., Sulu Archipelago, Tawitawi Group, coral, 9 fm., 4°58′20″N., 119°50′30″E., Feb. 24, 1908, *Alb.*, 1 female; Sta. 5561, Tutu Bay (Jolo), coral and sand, Sept. 19, 1909, *Alb.*, 1 female 1 juv. (? female); Labuan, Blanda Is., Buton Strait, marginal coral, Dec. 13, 1909, *Alb.*, 2 males, 1 female.

MEASUREMENTS.—Males, 9, 10 mm.; females, 10–18 mm.; juv. 8 mm.

DISTRIBUTION.—Madagascar, Seychelles, Japan, and Ceylon.

Thalamita parvidens (Rathbun)

FIGURE 30

Thalamonyx parvidens Rathbun, 1907, p. 62, pl. 5 (fig. 9).

Thalamita parvidens (Rathbun).—Sakai, 1939, pp. 425–426, fig. 19.—Stephenson, 1961a, pp. 122–124, figs. 2F, 4B, pls. 4 (fig. 1), 4K, 5H.—Crosnier, 1962, pp. 113–115, figs. 182, 185–187, 190, pl. 9 (fig. 2).

MATERIAL.—Philippines: Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 1 male, 1 female; Tunimdao I. Anchorage, Sulu Archipelago, vicinity Sibutu I., electric light, Feb. 25, 1908, *Alb.*, 1 male, 1 juv; Sta. 5169, Sibutu I., 4°32′15″N., 119°22′45″E., 10 fm., Feb. 27, 1908, *Alb.*, 1 male; Pascao, Ragay Gulf, electric light, Mar. 8, 1909, *Alb.*, 1 male; Mariveles, Luzon, June 27, 1913, A. M. Reese, 3 males.

Japan: Mogi, near Nagasaki, summer of 1900, Dr. D. S. Jordan and Mr. J. O. Snyder, 1 female.

MEASUREMENTS.—Males, 7–25 mm.; females, 8–13 mm.; juv., 8 mm.

REMARKS.—Stephenson (1961a) noted that Sakai's (1939) figure 16 does not show the most distal bristles on the inner side of the male

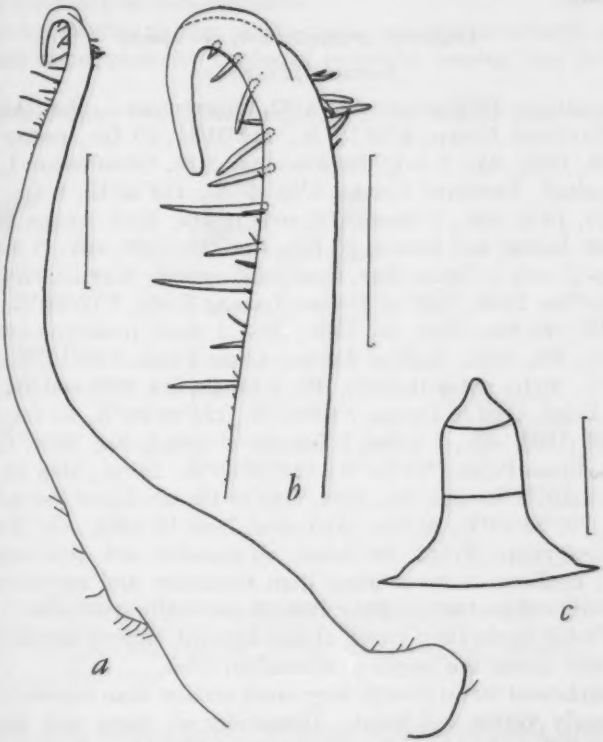

FIGURE 30.—*Thalamita parvidens* (Rathbun), male, Philippines, Mariveles, Reese: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.5 mm.; *c*, 5 mm.)

pleopod. The specimen here figured is roughly intermediate between Sakai's figure and Stephenson's (1961a) figure 4B. Crosnier's (1962) figures 185 and 186 show numerous long spines on both sides of the tip of the appendage, more than possessed by any of the present specimens.

Crosnier's figure (fig. 190) of the male abdomen shows a straight-sided ultimate segment. In the larger of the present specimens and

in the one figured by Stephenson (1961a, pl. 4, fig. K), the sides are distinctly concave.

Minor differences in general facies as between the descriptions of different authors have been noted by Crosnier. Possibly later study will show the existence of several subspecies.

DISTRIBUTION.—Madagascar, Carolines, Japan, and Western Australia.

Thalamita philippinensis, new species

FIGURE 31; PLATE 8A

MATERIAL.—Philippines: Sta. 5163, Observation I., Sulu Archipelago, Tawitawi Group, 4°59′10″N., 119°51′E., 28 fm., coarse sand, Feb. 24, 1908, *Alb.*, 2 ovig. females; Sta. 5165, Observation I., Sulu Archipelago, Tawitawi Group, 4°58′20″N., 119°50′E., 9 fm., coral, Feb. 24, 1908, *Alb.*, 3 females (1 ovig.); Sta. 5218, Anima Solo I., between Burias and Luzon, 20 fm., Apr. 22, 1908, *Alb.*, 5 males, 5 females (1 ovig.); Davao Bay, from pearl oysters, May 18, 1908, *Alb.*, 1 male; Sta. 5249, Gulf of Davao, Lanang Point, 7°06′06″N., 125°40′08″E., 23 fm., May 18, 1908; *Alb.*, 1 male (holotype—cat. no. 112238); Sta. 5251, Gulf of Davao, Linao Point, 7°05′12″N., 125°39′35″E., 20 fm.; May 18, 1908, *Alb.*, 1 female; Sta. 5252 and Sta. 5253, Linao Point, Gulf of Davao, 7°04′48″N., 125°39′38″E., 28 fm., coral, May 18, 1908, *Alb.*, 3 males, 2 females (1 ovig.); Sta. 5254, Gulf of Davao, Linao Point, 7°05′12″N., 125°39′35″E., 20 fm., May 18, 1908, *Alb.*, 1 male, 2 females; Sta. 5254, Gulf of Davao, Linao Point, 7°05′42″N., 125°39′42″E., 21 fm., sand coral, May 18, 1908, *Alb.*, 2 males.

DESCRIPTION.—Front: Six lobes, all rounded and distinctly separated; medians on lower plane than remainder and approximately two-thirds width of submedians; laterals roundedly triangular. Inner orbital lobes moderately broad, almost straight, sloping slightly backward, and almost the length of submedian lobes.

Anterolateral teeth: Fourth very much smaller than remainder, but still clearly visible and blunt. Remainder all sharp with first the stoutest, followed by second, with third and fifth fairly slender.

Carapace: Covered with short pile and finely granular. All normal ridges present excepting anterior mesobranchial and cardiac. Mesogastrics interrupted in midline, and epibranchial broadly interrupted at cervical grooves.

Basal antennal joint: Shorter than major diameter of orbit (ca. 0.8 times in larger specimens) and bearing short acute ridge with rounded granules.

Chelipeds: Coarsely granular on upper surfaces and smooth below. Right much stouter than left. Anterior border of arm bearing three stout spines and one or more tubercles. Spine at inner angle of wrist

stout and well developed, three spines on outer surface, sometimes reduced to tubercles. Upper surface of hand with inner and outer spine near middle and with two normal distal spines often reduced to rounded tubercles. Outer surface typically with three carinae, lowermost running to immovable finger, distinct granular middle carina and indistinct granular upper carina. In larger chelae of male these carinae indistinct or unrecognizable.

Fifth leg: Merus slender (L/B=ca. 3), smooth posteriorly except for usual spine; posterior border of propodus bearing four to eight spines.

Male abdomen: Penultimate segment much broader than long (ca.

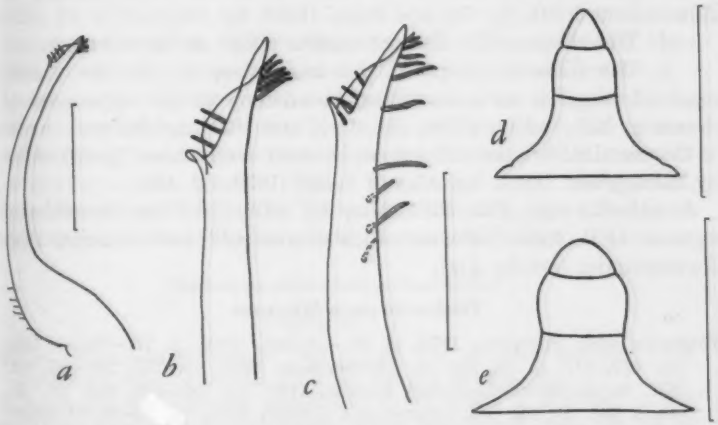

FIGURE 31.—*Thalamita philippinensis*, new species, male holotype: *a*, pleopod; *b*, pleopod tip, upper surface; *d*, abdomen. Philippines, Sta. 5218, *Alb.*: *c*, pleopod tip, upper surface. Philippines, Sta. 5254, *Alb.*, 25 mm. male; *e*, abdomen. (Scales=*a*, 1 mm.; *b*, *c*, 0.5 mm.; *d*, *e*, 5 mm.)

1½ times) with bulging sides. Ultimate segment rounded equilateral triangle.

Male first pleopod: Fairly stout, smoothly curving to oblique tip bearing flared membrane. Both sides without armature until near tip. Here outer surface typically with five to seven stout subterminal spines directed obliquely forward and decreasing in size toward tip, and usually with two or three thinner bristles widely spaced and lying back from tip. In largest male single subterminal spine present. Inner surface bearing two to four stout spines opposite widest portion of flared membrane; these almost at right angles to appendage.

MEASUREMENTS.—Males, 7–14 mm.; females, 8–12 mm.; ovig. females, 7–12 mm.

REMARKS.—This species keys out with *T. wakensis* Edmondson (1925) and *T. picta* Stimpson (1858). (See Stephenson and Hudson, 1957, p. 316.) It is closest to *T. wakensis*, sharing with it possession of a distinctly granular basal antennal joint and a male pleopod with stout anteriorly directed bristles on the outer side near the tip. It differs from *T. wakensis* in:

a. More rounded median and submedian frontal lobes; see Edmondson (1925, fig. 7a; 1954, fig. 36a) and Sakai (1939, fig. 13a).

b. Longer and less arched inner orbital lobes lying farther behind the front. Only in the two smallest specimens are the lobes relatively arched.

c. Reduction of spines to tubercles upon the wrist and arm; see Edmondson (1925, fig. 7c) and Sakai (1939, fig. 13c).

d. The absence of a distinct cardiac ridge on the carapace.

e. The different shape of the male pleopod. In the present material, there is no subterminal broadening of the appendage as shown in Edmondson (1954, fig. 36c), and the numbers and shapes of the terminal bristles differ conspicuously from those figured either by Edmondson (1954, fig. 36d) or Sakai (1939, fig. 13b).

A male (25 mm., Sta. 5254, May 18, 1908, *Alb.*) has the ultimate segment of its male abdomen much shorter and more rounded than the remainder (see fig. 31*e*).

Thalamita picta Stimpson

Thalamita picta Stimpson, 1858, p. 39.—Alcock, 1899, p. 79.—Sakai, 1939, pp. 413, 417, pl. 51 (fig. 2).—Edmondson, 1954, pp. 253, 263–264, figs. 35b, 36e–h.—Stephenson and Hudson, 1957, pp. 344–346, figs. 2A, 3A, pls. 4 (fig. 2), 8K, 10I.—Forest and Guinot, 1961, pp. 33–34.—Crosnier, 1962, pp. 138–139, figs. 237–240, pl. 12 (fig. 2).—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).—Garth, 1965, pp. 12–14, figs. 7, 11, 12.

Goniosoma lineatum A. Milne Edwards, 1861, p. 377, pl. 35 (figs. 1, 1a–b).—Richters, 1880, p. 153—Lenz, 1905, pp. 360–361, pl. 48 (figs. 5, 5a–e).

Thalamita gardineri Borradaile, 1902, pp. 205–206, fig. 36.—Rathbun, 1911, p. 209.

Thalamita alcocki de Man, 1902, pp. 646–650.—Edmondson, 1954, pp. 264–265, figs. 37a, b.

Charybdis lineata (A. Milne Edwards).—Balss, 1934, p. 505.

Thalamita roosevelti Schmitt, 1939, p. 16, fig. 2.

?*Thalamita investigatoris* Alcock, 1899, pp. 85–86.—Alcock and Anderson, 1900, p. 8, pl. 47 (figs. 1, 1a).—Barnard, 1954b, p. 124, fig. 4.

MATERIAL.—Philippines: Sta. 5593, Mount Putri, Borneo, 4°02′40″N., 118°11′20″E., 38 fm., fine sand, Sept. 29, 1909, *Alb.*, 1 female.

Marianas: Saipan, coral heads, 1945, coll. A. H. Banner, 1 male.

Marshalls: Eniwetok Reef, low tide, February 1946, F. C. Ziesenhenne, 1 male; Sta. 4442, Yonsyaran I., Bikini Atoll, May 16, 1946,

coll. Johnson, 1 male; Sta. 4449, Eniwetok I., Eniwetok Atoll, under rocks, rock flats, east side of island, May 20, 1946, J. P. E. Morrison, 1 male; E1–121, Arno Atoll, received 1952, 1 female; Jaluit Atoll, October 1960, Rehder, 1 female.

Samoa: U–01015, Schultz, 1 female.

Hawaii: Kilanoa Volcano House, Otto Degener, 1 ovig. female; following from Waikiki Marine Lab., Honolulu, G. S. Mansfield; under stones near shore: Feb. 9, 1942, 1 male; Mar. 13, 1942, 4 males; Mar. 28, 1942, 1 male.

Tuamotus and Societies: Sta. 29a–57, outer reef Tikahau Atoll, Maiai I., near coral rampart, Apr. 14, 1957, Bredin Exped., 1 female.

MEASUREMENTS.—Males, 9–27 mm.; females, 11–20 mm.; ovig. females, 14, 17 mm.

REMARKS.—Crosnier (1962) has examined Milne Edwards' type of *Goniosoma lineatum* and has shown that it belongs to *T. picta*.

DISTRIBUTION.—Examination of specimens from Clipperton I., kindly forwarded by Dr. John S. Garth, confirms that this species extends farther east than others in the genus and that *T. roosevelti* is a synonym (see Garth, 1965). Previously from Madagascar, Mozambique, and Red Sea to Tuamotus, including Japan and Australia (Stephenson and Hudson, 1957; Forest and Guinot, 1961).

Thalamita pilumnoides Borradaile

FIGURE 32

Thalamita pilumnoides Borradaile, 1903, p. 207, figs. 38, 38a.—Holthuis, 1953, p. 8 (record only).—Crosnier, 1962, pp. 150–151, fig. 253–256.

Not *Thalamita pilumnoides* var. *gatavakensis* Nobili, 1906b, p. 262; 1907, p. 384.

Not *Thalamita pilumnoides gatavakensis* Forest and Guinot, 1961, pp. 34–36, figs. 23–25.

MATERIAL.—Marianas: Saipan, in coral heads, 1945, A. H. Banner, 1 male, 1 ovig. female.

Tuamotus and Societies: Sta. 80–57 Raiatea, Uturoa, off northern end Taoru I., branching coral, depth 2–3 ft., Apr. 29, 1957, Bredin Exped., 1 female; Sta 90a–57 Huahine, off Point Teffaao, collected from dead coral, May 2, 1957, Bredin Exped., 2 males, 1 female, 3 ovig. females; Sta. 103–57, W. of Waroa Pass, Moorea, reef, May 7, 1957, Bredin Exped., 1 female.

MEASUREMENTS.—Males, 3–5 mm.; females, 4 mm.; ovig. females, 4–5 mm.

REMARKS.—Forest and Guinot (1961) pointed out that *Thalamita pilumnoides* var. *gatavakensis* Nobili differed from Borradaile's species in a number of particulars and left open the question as to whether it really belonged to another species. Two males in the present collection bear pleopods, and their marked difference from those

figured by Forest and Guinot indicates clearly that they were dealing with a different species. Independently Crosnier (1962) came to the same conclusion after reference to Borradaile's type and has redescribed the present species.

Apart from the pleopods, the following obvious features separate the present specimens from *T. gatavakensis:* Upper surface of cheliped covered with sharp tubercles instead of small granules; three spines on inner side of upper surface of the hand of the cheliped, instead of two; and relatively shorter basal antennal joint with about four as against six granules.

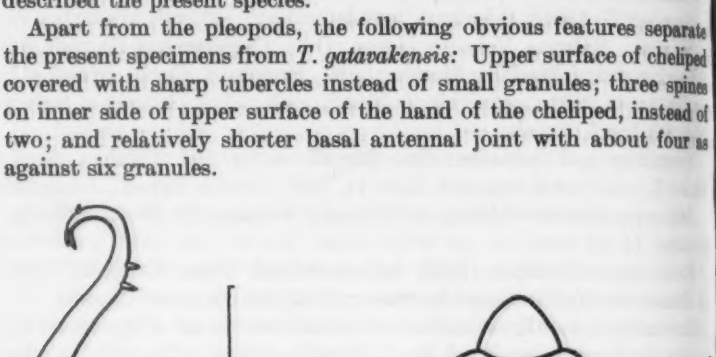

FIGURE 32.—*Thalamita pilumnoides* Borradaile, male, Tuamotus and Societies, Sta. 90a–57, Bredin: *a*, pleopod; *b*, abdomen. (Scales=*a*, 0.5 mm.; *b*, 1 mm.)

The male abdomen (fig. 32*b*) of the present specimen has the penultimate segment much broader than long, and the sides are less sinuous than in Crosnier's figure. The ultimate segment is broader than long in the present specimen, against as long as broad in Crosnier's.

The male pleopod is smoothly curved, with two conspicuous bristles on the outer surface some distance behind the tip. In addition, near the tip there is a small spinule, and on the tip there are two bristles. These additional structures are absent from Crosnier's figure (1962, fig. 256).

The male (5 mm.) from the Marianas has three anterolateral teeth instead of the usual four on each side.

DISTRIBUTION.—Madagascar, Maldive-Laccadive Archipelago, and Marianas.

Thalamita poissonii (Audouin and Savigny)

Portunus poissonii Savigny 1817, pl. 4 (figs. 3 [1–2], 5 [1–2].)—Audouin, 1825, p. 84 [fide Stephensen, 1945, and Crosnier, 1962].

Thalamita poissonii (Audouin and Savigny).—de Man, 1880, p. 181.—Alcock, 1899, p. 81.—Borradaile, 1903, p. 201.—Nobili, 1906b, p. 206.—Rathbun, 1911, p. 208.—Klunzinger, 1913, p. 263, pl. 4 (figs. 12a–b).—Balss, 1924, p. 4.

Thalamita poissoni (Audouin and Savigny).—Crosnier, 1962, pp. 116–117, figs. 183, 188, 192, pl. 10 (fig. 1).

Not *Thalamita poissonii* Sakai, 1939, pp. 423–424, text-fig. 17, pl. 85 (fig. 2) (=*T. pseudopoissoni*, new species).

MATERIAL.—East Africa: Ras Banas, Red Sea, 1950, Sozon Vatikiotis, 2 males (36 mm., 45 mm.).

Marshalls: S–46–44, dredged 180–200 ft., Bikini Lagoon, Mar. 29, 1946, L. P. Schultz, 2 females (8 mm., 19 mm.).

REMARKS.—See under *T. pseudopoissoni*.

DISTRIBUTION.—Madagascar, Red Sea and Suez, Laccadive Is., and Ceylon.

Thalamita prymna (Herbst)

Cancer prymna Herbst, 1803, pp. 41–42, pl. 57 (fig. 2).

Thalamita prymna (Herbst).—H. Milne Edwards, 1834, p. 461.—Alcock, 1899, pp. 78–79.—Sakai, 1939, pp. 413, 416, pl. 51 (fig. 1).—Stephenson and Hudson, 1957, pp. 346–349, figs. 2R, 3R, pls. 4 (fig. 3), 8L, 9E.—Sankarankutty, 1961a, p. 107.—Crosnier, 1962, pp. 136–138, figs. 234–236.—Guinot, 1962, p. 3.—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

MATERIAL.—Malay Peninsula: Koh Pipedon, Siam, Mar. 10, 1925, H. M. Smith, 1 male; Kok Gao, Siam, in coral, shoal water, Sept. 24, 1928, H. M. Smith, 1 juv.

Philippines: Near Sta. 5184, between Panay and Negros, surface, Mar. 30, 1908, *Alb.*, 2 males, 1 female; Little Santa Cruz I., Zamboanga, Mindanao, soft coral, marginal reefs, May 26, 1908, *Alb.*, 1 female; Point Jarnelo, Luzon, 150 ft. seine, July 13, 1908, *Alb.*, 1 male, 2 females; Sablayan, Mindanao, shore work collection, tide pool, Dec. 13, 1908, *Alb.*, 1 male, 1 female, 1 ovig. female; Batan I., tide pool, June 5, 1909, *Alb.*, 2 males, 1 female; Canino I., near Daet, June 15, 1909, *Alb.*, 3 males, 1 female, 1 ovig. female; Batan I., July 22, 1909, *Alb.*, 1 male, 1 ovig. female; Pilas I., tide pool, Sept. 12, 1909, *Alb.*, 1 male.

Australia: Arnhem Land Expedition, M48–21, reef at Yirrkala, NW. of Cape Arnhem, Aug. 12, 1948, R. R. Miller, 1 ovig. female.

Melanesia: Vila Efate, New Hebrides, Mar. 27, 1929, Herre collection, 1 male; Waigin, June 6, 1929, Herre collection, 1 female; Can "D," presumably New Guinea, received December 1944, Meyer, 1 ovig. female; as above, Can "K," 1 male.

Palau Is.: Palau I., Sta. 125–1187, about 1¾ mi. NE. of Ngabadongu, 7°17′36″N., 134°21′42″E., 17 fm., Aug. 24, 1955, GVF, 1 female.

Marianas: Tumon Bay, Guam, Sta. 80/x–30, N.M.R.V. No. 2, June 27, 1945, 1 female; Agfayan Bay, Guam, 145/RHB–150, July 7, 1945, R. H. Baker, 1 male, 1 female; Tumon Bay, Guam, Sta. 147–RHB–153, July 10, 1945, R. H. Baker, 1 male; Tumon Bay, Guam, 174/RHB/153, July 10, 1945, R. H. Baker, 1 male; Guam, December 1945, D. G. Frey, 1 male; Oca Point, Guam, January 1946, D. G. Frey, 1 male.

Japan: Akune, *Alb.*, 1 male, 1 female; Tanego Shima, 1906, *Alb.*, 2 males, 4 females; Okinawa, 1906, *Alb.*, 2 males.

Samoa: No. 14, Apia, outer reef, 1902; *Alb.*, 1 male; Apia, at mouth of river, June 1, 1902, *Alb.*, 1 female; Apia, outer reef, June 27, 1902, *Alb.*, 5 males, 2 females, 2 ovig. females; Apia, outer coral reef at low tide, July 1, 1902, *Alb.*, 1 ovig, female; Apia, outer reef, July 1902, *Alb.*, 2 males, 1 female, 1 ovig. female; Pago Pago, no. 10, August 1902, *Alb.*, 1 male, 1 female.

Measurements.—Males, 14–62 mm.; females, 19–51 mm.; ovig. females, 36–54 mm.; juv., 19 mm.

Remarks.—In unworn specimens, the basal antennal joint bears about five sharp teeth or spines, but with progressive wear these appear to be reduced first to two teeth and eventually to none. The 2-toothed forms key out with Stephenson and Hudson (1957, p. 316, couplet 8) to *T. tenuipes* Borradaile, 1902, which is possibly a synonym. Forms without teeth may key out as *T. picta*, but in this case the basal antennal joint is never acute as in *T. picta* and rarely completely smooth.

The nonovigerous female (42 mm. from Apia, Samoa, outer reef, July 1902) has only four anterolateral teeth on the right side, the second and third of those normally present being fused.

Distribution.—Delagoa and Red Sea to Marshalls, including Japan and Australia.

Thalamita pseudopoissoni, new species

Figure 33; Plate 8b

Thalamita poissonii Sakai, 1939, pp. 423–424, fig. 17, pl. 85 (fig. 2).
not *Portunus poissonii* Savigny, 1817, pl. 4 (figs. 3 [1–2], 5 [1–2]).
Audouin, 1825, p. 84 [fide Stephensen, 1945].
Not *Thalamita poissoni* Stephensen, 1945, pp. 131–136, figs. 32A–H.

Material.—Philippines: Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 1 male (8 mm.).

Palau Is.: Sta. 125–1187, about 1¾ mi. NE. of Ngabadongu, 7°17′36″N., 134°21′E., 17 fm., Aug. 24, 1955, GVF, 1 male (8 mm.—

holotype—cat. no. 112–233), 2 ovig. females (6 mm., 7 mm.), 1 juv. (5 mm.).

Uncertain locality: Bearing two contradictory labels as follows: "Nagasaki" and "Sta. 5254, Gulf of Davao, Linao Point, 7°05′42″N., 125°39′42″E., 21 fm., sand, coral, May 18, 1908, *Alb.*," 1 male (10 mm.), 1 female (18 mm.). The male, which is the figured specimen, would have been selected as a holotype except for locality uncertainty.

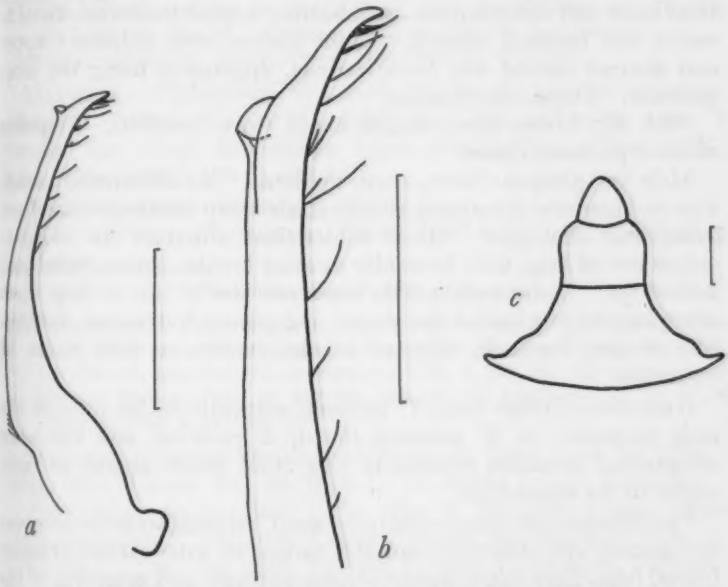

FIGURE 33.—*Thalamita pseudopoissoni*, new species, male paratype, Philippines, Sta. 5254, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, *c*, 1 mm.; *b*, 0.5 mm.)

DESCRIPTION.—Front: Bilobed, median notch varying from small, but distinct (18 mm. female; 7, 6 mm. ovig. females) to barely detectable (10 mm. male, 6 mm. juv.). Near lateral margins each lobe slightly concave, then terminating abruptly. Inner orbital lobes short and barely arched.

Anterolateral teeth: Five. First stoutest, fourth distinctly the smallest, and fifth sharpest and more protruding.

Carapace: Central area typically smooth and shining, lateral and frontal areas pilose. All normal carapace ridges present excepting anterior mesobranchials; no central interruption in mesogastric; an indistinct interruption in cardiac. In 8 mm. male, posterior mesobranchials not visible.

Basal antennal joint: Much shorter than orbit, bearing short inconspicuous crest composed of fused granules.

Chelipeds: Typically equal in females and with right stouter than left in males. Anterior border of arm bearing two spines and tubercle, or three spines. Wrist with usual spines, that on inner margin being unusually long, about two-fifths length of palm.

Hands coarsely granular on upper surface, under surface with squamiform markings (sometimes faint). Upper surface with indistinct inner and outer carinae, each bearing a spine somewhat distal to center and terminal tubercle. Outer surface with indistinct upper and distinct central and lower carinae, uppermost being the most granular. Fingers short, stout.

Fifth leg: Merus short (length about twice breadth). Propodus without posterior spines.

Male first pleopod: Short, stout, tip flared. No subterminal armature on inner side (paratype) or only single sharp bristle showing from under row (holotype). Outer subterminal armature an elongate sparse row of long, thin, forwardly directed bristles concentrated just behind tip. Under surface with transverse row of two to four short sharp bristles just behind membrane, and general but sparse distribution of long forwardly directed bristles continuous with those of outer side.

Remarks.—Differs from *T. poissonii* markedly in the form of the male pleopods. In *T. poissonii* the tip is recurved, and the outer subterminal armature consists of long stout spines almost at right angles to the appendage.

The differences in the general facies are: Chelipeds are more granular and spinous with clearly recognizable carinae on outer surface of hand; frontal lobes have characteristic sinuous outlines; and propodus of the fifth leg is without spines.

The male pleopod greatly resembles that of *T. sexlobata*, but this species differs obviously in its 4-lobed front.

Distribution.—Previously Japan.

Thalamita quadrilobata Miers

Thalamita quadrilobata Miers, 1884, pp. 539–540, pl. 48 (figs. B, b). Alcock, 1899, pp. 84–85.—Stephenson and Hudson, 1957, pp. 349–350, figs. 2G, 3G, pls. 4 (fig. 4), 8M, 9F.

Material.—Philippines: Nearougas I., shore, coral head, Feb. 10, 1908, *Alb.*, 1 female.

Melanesia: An-ki, Malaita, Solomon Is., Apr. 23, 1929, Herre collection, 1 ovig. female.

Palau Is.: Palau Is., Oct. 13, 1933, Herre collection, 1 ovig. female.

Tuamotus and Societies: Stas. 56–57, 57–57, Bora Bora, dredged, Apr. 25, 1957, Bredin Exped., 1 female.

MEASUREMENTS.—Females, 27–33 mm.; ovig. females, both 20 mm.

DISTRIBUTION.—Although widespread (Seychelles, Andamans, Gilberts, and Australia), apparently not common.

Thalamita sexlobata Miers

Thalamita sexlobata Miers, 1886, pp. 196–197, pl. 16, figs. 2a, b, c.—Henderson, 1893, pp. 373–374.—Alcock, 1899, pp. 87–88.—Stephensen, 1945, pp. 136–137, figs. 32C, D.—Stephenson and Hudson, 1957, pp. 350–352, figs. 2B, 3B, pls. 5 (fig. 1), 8N, 10K.—Crosnier, 1962, pp. 117–118, figs. 195–198.
Thalamita sexlobata var. *plicatrifrons* de Man, 1902, pp. 651–653.

MATERIAL.—Philippines: Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb 21, 1908, *Alb.*, 1 female; Sta. 5595, Zamboanga Light, 6°54′00″N., 122°04′30″E., 9 fm., Oct. 7, 1909, *Alb.*, 1 female.

MEASUREMENTS.—Females 6, 12 mm.

DISTRIBUTION.—Madagascar, Persian Gulf to Tongataba, including Australia.

Thalamita sima H. Milne Edwards

Thalamita sima H. Milne Edwards, 1834, p. 460.—Alcock, 1899, pp. 81–82.—Sakai, 1939, pp. 414, 423, figs. 16a–c, pl. 51 (fig. 3).—Stephensen, 1945, pp. 126–128, figs. 27A–G.—Edmondson, 1954, p. 258, figs. 32e–h.—Stephenson and Hudson, 1957, pp. 352–354, figs. 2C, 3C, pls. 5 (fig. 2), 8O, 9G.—Crosnier, 1962, p. 111, fig. 181.

MATERIAL.—Malay Peninsula: Chumporn, Siam, Sept. 25, 1923, 1 male; Gulf of Siam, Apr. 30, 1934, H. M. Smith, 1 male, 2 females.

Philippines: Subig Bay, China Sea off southern Luzon, shore seine, sand, Jan. 7, 1908, *Alb.*, 1 male; Tataan, Simaluc, shore, Feb. 19, 1908, *Alb.*, 1 juv; Sta. 5158, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′N., 119°54′30″E., 12 fm., Feb. 21, 1908, *Alb.*, 1 male; Iloilo, Apr. 20, 1929, Kellers, 1 male, 2 females.

MEASUREMENTS.—Males, 8–39 mm.; females, 12–13 mm.; juv., 9 mm.

DISTRIBUTION.—Madagascar, Mozambique to Red Sea, eastward to Hawaii, including Japan and Australia.

Miers' (1876) record of this species from New Zealand has been cited by later workers including Stephenson and Hudson (1957) and Stephenson (1961b). Hutton (1882) has shown this record is highly questionable.

Thalamita spinifera Borradaile

FIGURE 34

Thalamita exetastica var. B *spinifera* Borradaile, 1902, p. 203.
Thalamita spinifera Borradaile.—Rathbun, 1906, pp. 874–875.—Edmondson,

1951, p. 221; 1954, pp. 269–270, figs. 41a–d, 42a.—Crosnier, 1962, pp. 125–127, figs. 210–211, 214–215, pl. 11 (fig. 1).

MATERIAL.—Philippines: Sta. 5158, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′N., 119°54′30″E., 12 fm., Feb. 21, 1908, *Alb.*, 1 ovig. female; Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 1 female; Sta. 5218, Anima Solo I., between Burias and Luzon, 20 fm., Apr. 22, 1908, *Alb.*, 1 female; Sta. 5253, Linao Point, Gulf of Davao, 7°04′48″N., 125°39′38″E., 28 fm., coral, May 18, 1908, *Alb.*, 1 male,

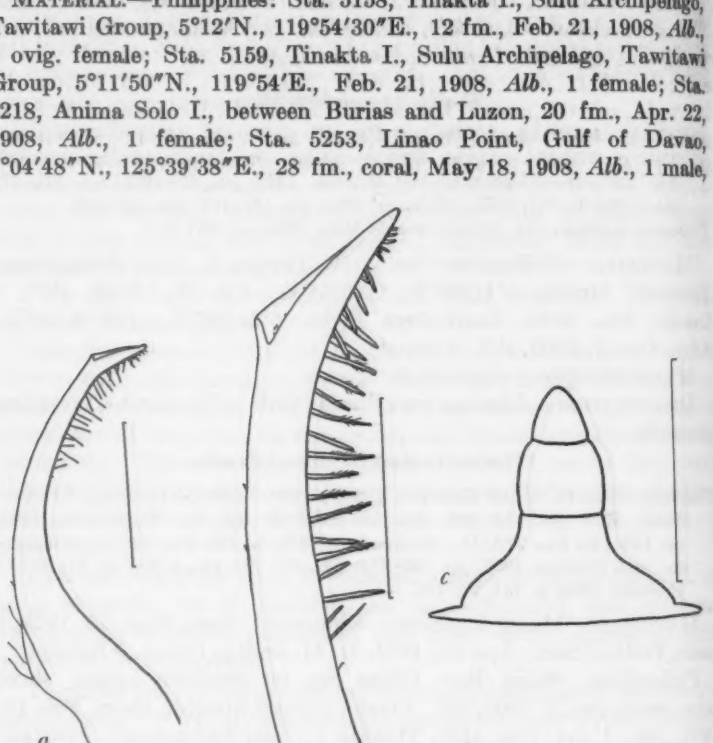

FIGURE 34.—*Thalamita spinifera* Borradaile, male, Philippines, Sta. 5253, *Alb.*: *a*, pleopod; *b*, pleopod tip, upper surface; *c*, abdomen. (Scales=*a*, 1 mm.; *b*, 0.5 mm.; *c*, 5 mm.)

1 female, 4 ovig. females; Sta. 5254, Gulf of Davao, Linao Point, 7°05′42″N., 125°39′42″E., 21 fm., sand, coral, May 18, 1908, *Alb.*, 1 fragmented female; Sta. 5401, Tanguingui I., North of Cebu, 11°24′45″N., 124°06′E., 30 fm., Mar. 16, 1909, *Alb.*, 1 female.

MEASUREMENTS.—Male, 14 mm.; females, 11–14 mm.; ovig. females, 11–14 mm.

REMARKS.—The male pleopod which has been figured by Edmondson (1954, figs. 41c,d) is here refigured together with the male abdomen (figs. 34*a–c*).

The pleopod is short, stout, slightly curved, and with flared truncated tip. Subterminal armature on outer side consisting of single well-spaced row of stout bipinnate bristles, about 30 in number and decreasing in size distally. Inner surface with only a few microscopic spinules.

DISTRIBUTION.—Madagascar, Maldive Archipelago, and Hawaii.

Thalamita spinimana Dana

Thalamita spinimana Dana, 1852a, p. 283, pl. 17 (fig. 8); 1852b, p. 85.—Sakai, 1936, p. 162, pl. 12 (fig. 1).—Shen, 1937, p. 131, fig. 17.—Stephenson and Hudson, 1957, pp. 354–355, figs. 20, 30, pls. 5 (fig. 3), 8P, 9H.

MATERIAL.—Malay Peninsula: Sri Raja, Siam, Feb. 5, 1927, 1 male. Philippines: Reefs opposite Cebu, Apr. 5, 1908, *Alb.*, 1 male; Reefs off Cebu, Apr. 7, 1908, *Alb.*, 4 males, 1 female; Culion, May 1931, Herre collection, 1 male.

Australia: M48–3, East Poisit Reef, Arnhem Land, ca. 6 mi. NNW. of Darwin, Mar. 26, 1948, coll. R. R. Miller, 1 male.

Palau Is.: Palau Is., Oct. 14, 1933, Herre collection, 1 female; Sta. 60-1011, W. of Ebadul's Pier, north end Koror I., sand and eel grass flats, Aug. 5, 1955, GVF, 1 male.

Marianas: Y–193 B.C., Balabat, Yap I., tidal flats from under rocks, received 1952, coll. Hiatt, 1 male.

MEASUREMENTS.—Males, 17–67 mm.; females, 26, 34 mm.

REMARKS.—The number of spines on the inner border of upper surface of hand is not constant at four, but varies from three (small specimens) to five (large specimens). Sometimes there are four on one hand, but either three or five on the other hand of the same specimen.

DISTRIBUTION.—Viti (Milne Edwards, 1861), Malaya to Palao (Shen, 1937), Australia (Stephenson and Hudson, 1957).

Thalamita spinimera, new species

FIGURE 35; PLATE 9

MATERIAL.—Marianas: Near Agaña, Guam, on alcyonarian, Nov. 12, 1953, Bronson, 1 female (9 mm.—holotype—cat. no. 112/418).

DESCRIPTION.—Front: Protruding, 6-lobed. Medians long, with rounded tips, protruding farthest and separated by deep broad notches from submedians. Submedians broad with slight outward inclination and separated by narrow notches from laterals. Inner orbital lobes erect and with spinous tips. Suborbital lobes also with stout spinous tips.

Anterolateral teeth: Five, all sharp. First three subequal, fourth the smallest, fifth much the longest.

Carapace: Broad, breadth about 1.6 times length, with very divergent anterolateral borders and very convergent posterolateral borders. Apart from ridges, covered with long sparsely arranged hairs, beneath which, in frontal region, beaded granules are concealed. Frontal ridges small and rounded; protogastrics short and inconspicuous; mesogastrics well developed, separated in midline, and each concave

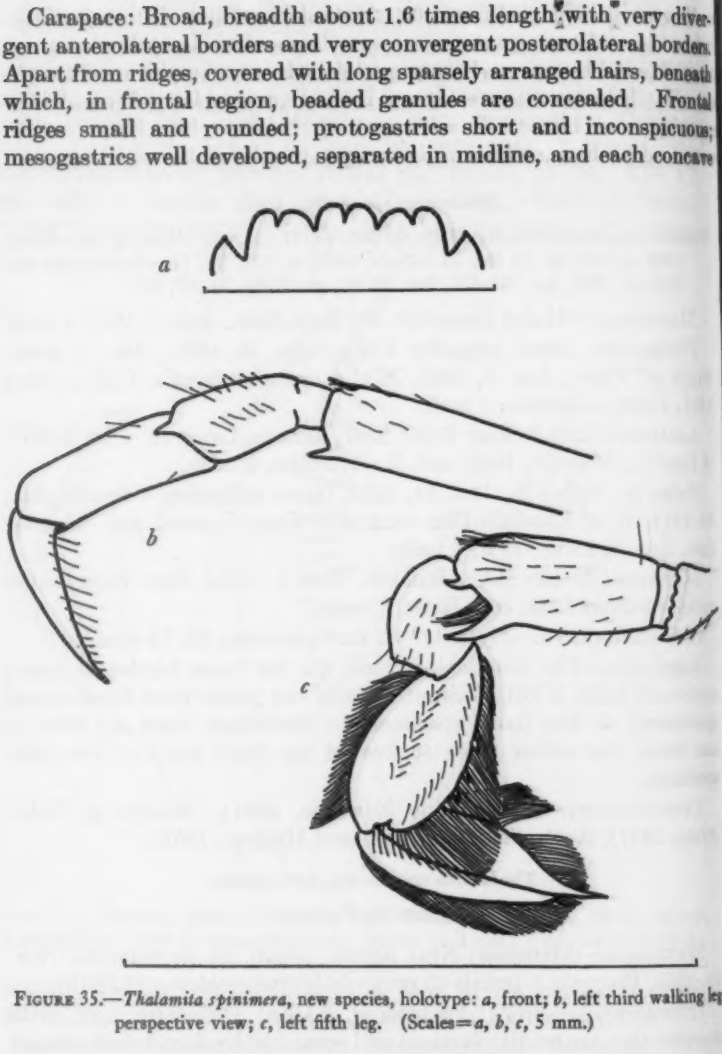

FIGURE 35.—*Thalamita spinimera*, new species, holotype: *a*, front; *b*, left third walking leg, perspective view; *c*, left fifth leg. (Scales=*a*, *b*, *c*, 5 mm.)

anteriorly. Epibranchials well developed and interrupted at cervical grooves but not medially. Two cardiacs, broadly separated in midline. Two short but conspicuous mesobranchials.

Basal antennal joint: Obliquely inclined, shorter than width of orbit (ca. 0.8 times), and with short but conspicuous crest bearing three spines.

Chelipeds: Equally sized, very spinous, and hirsute. Arm bearing five spines on anterior border, none on posterior border, and one on ventral surface just behind wrist articulation. Wrist with inner spine very well developed, with three usual outer spines and with additional spine on upper surface. Inner and outer carinae of wrist well developed. Hand with upper surface bearing four particularly well-developed spines (apart from one at wrist articulation), but corresponding inner and outer carinae not recognizable. Outer surface of hand peculiarly folded just behind articulation of movable finger, and bearing on lower surface a very conspicuous carina composed of large regularly arranged granules, and terminating just before beginning of immovable finger in a forwardly directed spine. Lower border of outer surface composed of a carina of regularly arranged granules, continuing along immovable finger. Inner surface of hand with coarsely granular subcentral carina. Under surface of hand granular and hairy. Fingers short, sharp, and strongly carinated.

Walking legs: Unique in possessing a spine on ventrodistal border of merus of each leg. Dorsodistal border of carpus of first and second legs bearing similar, but less obvious spine. Dactyls of all three legs with sharp spinous tips.

Fifth leg: Merus twice as long as broad and with spine on distal border particularly well developed, and another smaller spine on posterodistal angle. Dactyl sharp tipped.

Discussion.—This specimen is either a most unusual *Thalamita* or alternatively should be referred to a new genus. It resembles the species of the genus *Thalamonyx* A. Milne Edwards, 1873, in possessing inclined anterolateral borders and a protruding front. Stephenson and Hudson (1957, pp. 326–327) have already shown that inclined anterolateral borders are possessed by some species of *Thalamita* and have suggested that *Thalamonyx* should disappear into the synonymy of *Thalamita* (see also Stephenson and Campbell, 1960, p. 107).

It is uniquely spinose on the merus of all walking legs (hence the specific name), on the carpus of the first two legs, on the under surface of the arm of the chelipeds, and on the outer surface of the hand of the chelipeds. In addition the dactyls of the walking and swimming legs are more spinous than usual, and the spine on the posterior border of the merus of the fifth leg is particularly well developed. Presumably these are adaptations for its ectocommensal mode of life and are in the nature of special additions to the basic body plan of a typical *Thalamita*, rather than marked diversions from it. Apart from the spinous dactyls of the fifth legs, none of these adaptations are comparable with those in the genus *Caphyra*, which has presumably evolved separately and farther from *Thalamita*-like ancestors.

The limits of the genus *Thalamita* are already indefinite, and, as Stephenson and Hudson (1957, pp. 361–2) have noted, there is no logical separation from *Charybdis*. The recent discovery of a new species of *Thalamita* with spooned tips on the hands of the chelipeds (*T. stephensoni* Crosnier—see later) complicates the generic picture because it exhibits one of the diagnostic features of the genus *Thalamitoides*. Another feature, the very spinous upper surface of the hands of the chelipeds, is shown by the present species, although, in other respects (e.g., carapace width), they are not closely related.

Until more species are discovered on the various peripheries of the genus *Thalamita*, and the degrees of intergradation or segregation of such species with the remainder have been determined, it seems preferable to leave the genus with its present wide and indefinite boundaries.

Thalamita stephensoni Crosnier

Thalamita stephensoni Crosnier, 1962, pp. 140–142, figs. 241–248.

MATERIAL.—Melanesia: New Georgia, received Jan. 10, 1945, W. A. Bartos, 1 male—carapace only (7 mm.).

Samoa: Pago Pago, August 1902, *Alb.*, 1 ? male (10 mm.).

REMARKS.—Frontal lobes in the 7 mm. specimen are perfectly straight, and the external angles are sharp instead of rounded.

The male pleopod differs from that figured by Crosnier (figs. 243–245) in possessing only three spines on the outer side, and one instead of two just behind the tip on the inner side.

DISTRIBUTION.—Previously only Madagascar.

Thalamita stimpsoni A. Milne Edwards

FIGURE 36

Thalamita stimpsoni A. Milne Edwards, 1861, pp. 362, 367, pl. 35 (fig. 4).—Alcock, 1899, p. 79.—Sakai, 1939, pp. 413, 416–417.—Stephenson and Hudson, 1957, pp. 356–359, figs. 2M, 3M, pls. 6 (figs. 1–3), 8R, 9I.

MATERIAL.—Malay Peninsula: Koh Pipidon, Mar. 10, 1925, H. M. Smith, 2 males.

China: AT–51, Namru-2, Taipei, Formosa, 12 mi. S. of Tau Hsui, seashore, Lighthouse Beach, 1 male.

Philippines: Sta. 5144, Jolo Lighthouse, 6°05′50″N., 121°02′15″E., 19 fm., coarse sand, Feb. 15, 1908, *Alb.*, 1 male; Sta. 5145, Jolo Light, 6°04′30″N., 120°59′30″E., coarse sand, shells, 23 fm., Feb. 15, 1908, *Alb.*, 1 male, 2 females, 1 ovig. female; Sta. 5147, Sulade I., 5°41′40″N., 120°47′10″E., 21 fm., coarse sand, shells, Feb. 16, 1908, *Alb.*, 2 males; Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi, 5°11′50″N., 119°54′E., Feb. 21, 1908, *Alb.*, 2 males, 2 ovig. females, 1 *Sacculina* infected female, 2 juvs.; Sta. 5164, Observation

I., Sulu Archipelago, Tawitawi Group, 18 fm., green mud, Feb. 24, 1908, *Alb.*, 1 male; near Sta. 5184 between Panay and Negros, surface, Mar. 30, 1908, *Alb.*, 2 juvs.; reefs opposite Cebu, Apr. 7, 1908, *Alb.*, 1 male; Sablayan Bay, Mindoro, Dec. 12, 1908, *Alb.*,

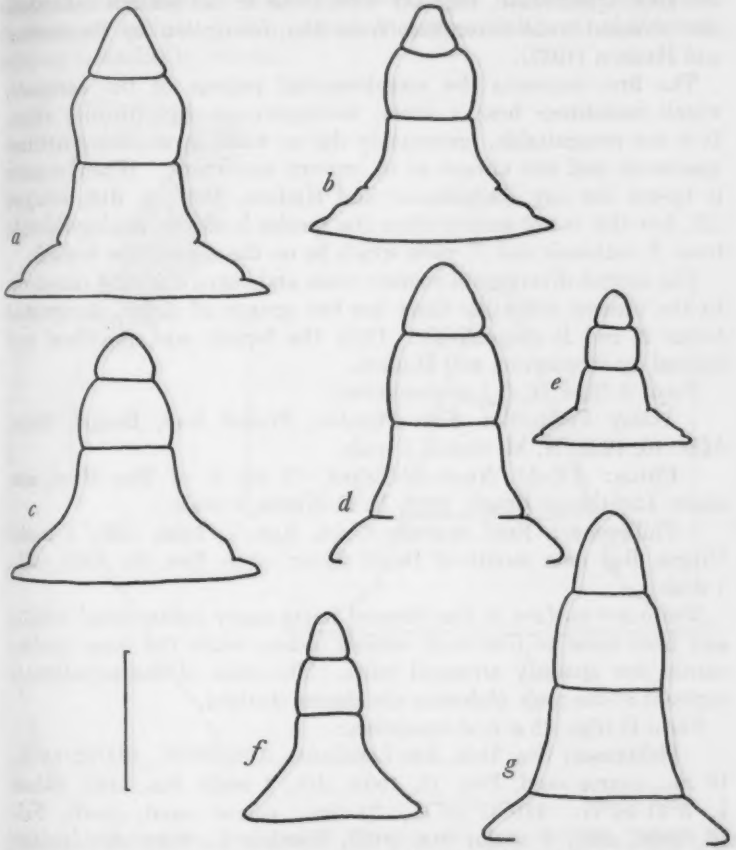

FIGURE 36.—*Thalamita stimpsoni* A. Milne Edwards, male abdomens: *a*, Philippines, Sta. 5147, *Alb.*, larger male; *b*, Philippines, Sta. 5144, *Alb.*; *c*, Philippines, Sta. 5159, *Alb.*; *d*, China, Taipei, AT–51; *e*, Philippines, Sta. 5164, *Alb.*; *f*, Philippines, Ulugan Bay, *Alb.*, 21 mm.; *g*, Philippines, reefs opposite Cebu, *Alb.* (Scale=5 mm.)

1 female; Ulugan Bay near mouth of Bahili River, seine, Dec. 28, 1908, *Alb.*, 2 males; Sta. 5561, Tutu Bay, Jolo, coral and sand, Sept. 19, 1909, *Alb.*, 1 male, 1 juv.

Marianas: Y–1289, Tomil Harbor, from under rocks, tidal flats, received 1952, Hiatt, 4 males, 2 females.

MEASUREMENTS.—Males, 8–35 mm.; females, 14–35 mm.; ovig. females, 19–24 mm.; *Sacculina* infected female, 26 mm.; juvs., 6–9 mm.

REMARKS.—Examination of numerous fresh specimens from Moreton Bay, Queensland, together with those in the present collection, has revealed some divergence from the description by Stephenson and Hudson (1957).

The first concerns the mesobranchial regions of the carapace, which sometimes bear a short, inconspicuous, but distinct ridge. It is not recognizable, presumably due to wear, in smoother hairless specimens and not always so in unworn specimens. When present it upsets the key (Stephenson and Hudson, 1957, p. 316, couplet 12), but this is not serious since the species is clearly distinguishable from *T. wakensis* and *T. picta* which lie on the alternative branch.

The second divergences concern male abdomens and first pleopods. In the present collection there are two groups of males, designated forms A and B respectively. Only the former was described and figured by Stephenson and Hudson.

Form A (figs. 36 *d*, *f*, *g*) comprises:

Malay Peninsula: Koh Pipedon, Pocket Bay, Benjal, Siam, Mar. 10, 1925, H. M. Smith, 1 male.

China: AT–51, Namru-2-Taipei, 12 mi. S. of Tau Hsui, seashore, Lighthouse Beach, 1957, R. E. Kuntz, 1 male.

Philippines: Reef opposite Cebu, Apr. 7, 1908, *Alb.*, 1 male; Ulugan Bay near mouth of Bahili River, seine, Dec. 28, 1908, *Alb.*, 1 male.

The outer surface of the pleopod bears many subterminal bristles and from none to five short conical spines, while the inner surface carries few sparsely arranged hairs. The sides of the penultimate segment of the male abdomen are almost straight.

Form B (figs. 36 *a–c*, *e*) comprises:

Philippines: Sta. 5144, Jolo Lighthouse, 6°05′50″N., 121°02′15″E., 19 fm., coarse sand, Feb. 15, 1908, *Alb.*, 1 male; Sta. 5147, Sulade I. 5°41′40″N., 120°47′10″E., 21 fm., coarse sand, shells, Feb. 16, 1908, *Alb.*, 1 male; Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°12′N., 119°54′30″E., 12 fm., Feb. 21, 1908, *Alb.*, 1 male; Sta. 5164, Observation I., Sulu Archipelago, Tawitawi Group, 18 fm., green mud, Feb. 24, 1908, *Alb.*, 1 male.

In form B the outer surface of the pleopod bears numerous subterminal robust spines, while the inner surface carries numerous spines or stout bristles, generally continuing some distance proximally. The sides of the penultimate segment of the male abdomen are markedly convex.

Young males of form B differ from the adults in that only few

subterminal spines are present on both sides of the pleopod, and the convexity of the sides of the penultimate abdominal segment is less marked.

A 34 mm. specimen from "Sta. AT–51; 1957; R. E. Kuntz," is somewhat intermediate between the two forms. There are no spines on the inner surface of the pleopod, but the penultimate abdominal segment is markedly convex.

FIGURE 37.—*Thalamitoides quadridens* A. Milne Edwards, male, Marshalls, Latobak I., Sta. 207, Bayer and Zimmerman: *a*, pleopod; *b*, abdomen. (Scales=*a*, 1 mm.; *b*, 5 mm.)

DISTRIBUTION.—India to Samoa, including Japan and Australia.

Genus *Thalamitoides* A. Milne Edwards, 1869

Thalamitoides quadridens A. Milne Edwards

FIGURE 37

Thalamitoides quadridens A. Milne Edwards, 1869, pp. 147–149, pl. 6, figs. 8–15.—de Man, 1887, p. 331.—Nobili, 1906a, p. 212.—Rathbun, 1907, p. 64 (record

only).—Edmondson, 1925, p. 40 (record only).—Gordon, 1934, p. 61.—Balss, 1938, p. 35.—Edmondson, 1954, pp. 270–271, figs. 23a–c, 24b.—Crosnier, 1962, pp. 144–145, figs. 249–251.

Thalamitoides alphonsei Ward, 1939, p. 3, figs. 3, 4.

MATERIAL.—Philippines: Sta. 5108, Corregidor Lt., 15°05′5″N., 120°14′45″E., China Seas, 13 fm., Jan. 15, 1908, *Alb.*, 1 male; Sta. 5109, Corregidor Lt., 14°03′45″N., 120°16′30″E., 10 fm., coral, Jan. 15, 1908, *Alb.*, 1 female.

Marshalls: Sta. II, Bikini Lagoon, 15 fm., sandy bottom with *Halimeda*, one-fourth mi. S. of west end, Aug. 7, 1946, J. P. E. Morrison, 1 female; Sta. VI, Bikini I., outer reef, Aug. 8, 1947, F. M. Bayer, 1 male, 1 female; Latobak I., Rongerik, Sta. 207, outer reef, Aug. 18, 1947, F. M. Bayer and F. C. Zimmerman, 1 male; Latobak I., Rongerik, Sta. 262, Aug. 21, 1947, F. M. Bayer and F. C. Zimmerman, 1 male; E2–361, Arno Atoll, received 1952, Hiatt, 3 males, 1 female.

Samoa: Apia, Samoa, at mouth of river, June 1, 1902, *Alb.*, 1 ovig. female.

Hawaii: Sta. 40, Oahu I., C. H. Edmondson, 1 male.

MEASUREMENTS.—Males, 8–24 mm.; females, 19–25 mm.; ovig. female, 27 mm.

REMARKS.—The male pleopod which has been figured by Edmondson (1954, fig. 43b, c) is here refigured and described. Short, stout, gently curved, bearing distally on inner surface two rounded membranous lobes. Subterminal armature on outer side a regular double row of elongate, closely spaced bristles merging into a distal clump of small to large bristles. On inner surface, few short hairs, and a number of recurved spines lying between the membranes.

Crosnier (1962) in redescribing Milne Edwards' type also concludes that *T. alphonsei* Ward is a synonym.

DISTRIBUTION.—Red Sea, Madagascar, Amboina, Samoa, Johnston I., and Jaluit.

Thalamitoides tridens A. Milne Edwards

FIGURES 38

Thalamitoides tridens A. Milne Edwards, 1869, pp. 149–158, pl. 6 (figs. 1–7).—de Man, 1881, p. 99; 1889, pp. 423–424.—Ortmann, 1893, p. 86.—Nobili, 1901, p. 10.—Klunzinger, 1913, pp. 361–363.—Edmondson, 1925, p. 40 (under *T. quadridens*).—Crosnier, 1962, p. 143, fig. 250.

Hedrophthalmus thalamitoides Nauck, 1880, p. 59, pl. 1 (fig. 25) [fide Nobili, 1906a].

Thalamitoides tridens var. *spinigera* Nobili, 1905, p. 403; 1906a, p. 213.

Thalamita (*Thalamitoides*) *tridens* A. Milne Edwards.—Boone, 1934, pp. 79–81 pl. 36.

Thalamitoides tridens typica A. Milne Edwards.—Balss, 1938, p. 35.—Edmondson, 1954, p. 271.

Thalamitoides tridens spinigera Nobili.—Balss, 1924, p. 5; 1938, p. 35 (under *T. tridens typica*).

MATERIAL.—Philippines: Sta. 5159, Tinakta I., Sulu Archipelago, Tawitawi Group, 5°11′50″N., 119°54′E., Feb 21, 1908, *Alb.*, 1 female.

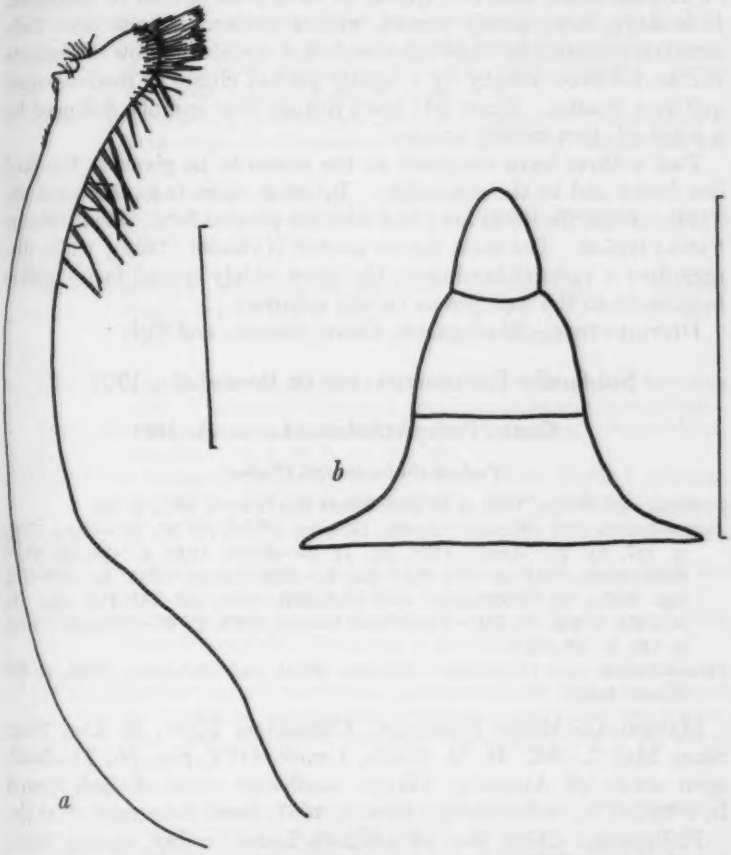

FIGURE 38.—*Thalamitoides tridens* A. Milne Edwards, largest male, Samoa, Apia, July 1902, *Alb.*: *a*, pleopod; *b*, abdomen. (Scales=*a*, 1 mm.; *b*, 5 mm.)

Marshalls: Rongelap Lagoon, 1 mi. W. of Rongelap I., 20 fm., June 21, 1946, Taylor, 1 female.

Samoa: Apia, at mouth of river, June 1902, *Alb.*, 4 males, 3 females; Apia, outer coral reef at low tide, July 1, 1902, *Alb.*, 2 females; Apia, coral reef, July 1902, *Alb.*, 3 males, 1 female; Pago Pago, August 1902, *Alb.*, 3 males, 2 females, 2 ovig. females.

Palau: Sta. 333, Kapingamarangi, July 20, 1954, C. Hand, 1 juv.

MEASUREMENTS.—Males, 14–24 mm.; females, 11–22 mm.; ovig. females, 14, 15 mm.; juv. 10 mm.

REMARKS.—The male pleopod, which shows resemblances to that of *T. quadridens*, does not appear to have been figured or described. It is short, stout, gently curved, with a swollen truncate tip. Subterminal armature on outer side consists of a scattered row of elongate bristles followed distally by a tightly packed clump of medium-sized and long bristles. Inner side bears distally four spinules followed by a patch of short curved bristles.

Past authors have disagreed on the status to be given to the Red Sea forms and to the remainder. In some cases (e.g., Edmondson, 1954), subspecific ranks are given with the present form, *Thalamitoides tridens typica*. The most recent author (Crosnier, 1962), while disregarding a varietal heading to the more widely spread forms, refers to those from the Red Sea as variety *spinigera*.

DISTRIBUTION.—Madagascar, Guam, Samoa, and Fiji.

Subfamily PODOPHTHALMINAE Borradaile, 1907

Genus *Podophthalmus* Lamarck, 1801

Podophthalmus vigil (Weber)

Portunus vigil Weber, 1795, p. 93 [fide Forest and Guinot, 1961, p. 36].

Podophthalmus vigil (Weber).—Boone, 1934, pp. 81–85, pls. 37, 38.—Shen, 1937, p. 137, fig. 20.—Leene, 1938, pp. 12–13.—Sakai, 1939, p. 427, pl. 48.—Stephensen, 1945, p. 137, figs. 32a, b.—Edmondson, 1954, pp. 271–272, figs. 43d,e, 44.—Stephenson and Campbell, 1960, pp. 115–116, figs. 1I, 2O, pls. 5 (fig. 1), 5O.—Forest and Guinot, 1961, p. 36.—Crosnier, 1962, p. 146, pl. 13 (fig. 1).

Podophthalmus vigil (Fabricius).—Miyake, Sakai, and Nishikawa, 1962, p. 128 (record only).

MATERIAL.—Malay Peninsula: Chantabun River, at Lem Sing, Siam, May 7, 1927, H. M. Smith, 1 male; GVF, Sta. 55, Thailand, open ocean off Aangtong Village, southwest coast of Goh Samui I., 9°31′38″N., 99°51′35″E., Nov. 6, 1957, local fisherman, 1 male.

Philippines: China Sea, off southern Luzon, Subig, electric light, dip net, Jan. 6, 1908, *Alb.*, 2 males, 2 females.

Hawaii: Oahu, Sta. 6, dredge 13.5 m., July 1930, 1 female, 1 juv.

Tuamotus and Societies: Sta. 101 southeastern end of Opunohu Bay (= Papetoai Bay), Moorea I., wire crab trap left down overnight in 10–12 fm., May 6–7, 1957, Bredin Exped., 1 female.

MEASUREMENTS.—Males, 16–123 mm.; females, 19–91 mm.; juv., 10 mm.

DISTRIBUTION.—Red Sea and Madagascar to Hawaii, Samoa and Tahiti, including Japan and Australia.

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TABLE 1.—*Tabulation of* Thalamita edwardsi*-like characters* (−) *and* T. admete*-like characters* (+) *in 30 male specimens*

General characters				Pleopod characters			Specimen data	Summary
Cardiac ridge present	Postr. mesobranch. ridge present	Well-carinated chelae	4th A.L. tooth just present	Uniform size large spines on outside	Fewer large size spines on inside	Inner spines extending short distance backward		
−	−	−	−	−	+	−	Nau Wan Formosa, Jan. 27, 1910 (see fig. 20 f)	
−	−	chelipeds absent	−	−	+	+	Apia Samoa, June 1902 (see fig. 20e)	General characters near *edwardsi*, pleopod characters midway
−	−	+	−	−	+	−	Philippine Is., E. A. Mearns	
−	+	−	−	+	−	−	1945 Hawaiian Is.	
−	+	−	−	−	+	−	1945 Honolulu (see fig. 20*a*)	General characters near *edwardsi*, pleopod characters midway
−	+	chelipeds absent	−	+	+	−	Mar. 13, 1942, Honolulu	
−	+	−	+	+	+	−	Apr. 6, 1942, Honolulu	near midway
−	−	−	+	+	+	+	Apr. 12, 1957, Tickatau Atoll, 13 mm.	
−	+	−	−	+	+	+	Apr. 12, 1957, Tickatau Atoll, 10 mm.	General characters midway, pleopod characters *admete*
−	+	−	−	+	+	+	Mar. 6, 1942, Honolulu	
−	+	−	−	+	+	+	Mar. 23, 1942, Honolulu, 28 mm.	
+	+	−	+	+	+	+	Mar. 23, 1942, Honolulu, 38 mm.	General characters near *admete*, pleopod characters *admete*
+	+	−	+	+	+	+	July 13, 1945, Oahu.	
+	+	−	+	+	+	+	1913, 17 mm.	
−	+	+	−	+	−	−	Makiwa Reef, June 19, 1927	near midway

TABLE 1.—Continued.

General characters				Pleopod characters			Specimen data	Summary
Cardiac ridge present	Postr. mesobranch. ridge present	Well-carinated chelae	4th A.L. tooth just present	Uniform size large spines on outside	Fewer large size spines on inside	Inner spines extending short distance backward		
+	+	+	+	+	−	−	Makasson I., 1909, *Alb* (see fig. 20*h*)	
+	+	+	+	+	−	−	Gt. Tobea I., Dec. 15, 1909, *Alb.*, 18 mm.	
+	+	+	+	−	+	−	Guam, 1945	General characters *admete* pleopod characters midway
+	+	+	+	+	+	−	Samoa, June 27, 1902, 23 mm. (see fig. 20*d*)	
+	+	+	+	+	−	−	Samoa, Aug. 1902, 17 mm. (see fig. 20*g*)	
+	+	+	?	+	−	+	Gt. Tobea I., Dec. 15, 1909, *Alb.*, 31 mm.	
+	+	+	+	+	−	+	Gt. Tobea I., Dec. 15, 1909, *Alb.*, 27 mm.	
+	+	+	+	+	−	−	August 1948, 21 mm. (see fig. 20*b*)	
+	+	+	+	+	+	+	Society Is., 1945	
+	+	+	+	+	+	+	Samoa, June 27, 1902, 21 mm. (see fig. 20*c*)	
+	+	+	+	+	+	+	1913, 20 mm.	
+	+	+	+	+	+	+	1913, 18 mm.	All characters *admete*
+	+	+	+	+	+	+	1929, Fiji	
+	+	+	+	+	+	+	Tomil Hbr., 1952	
+	+	+	?	+	+	+	Bikini, 1947	

TABLE 2.—*Variability in armature of male pleopods in* Thalamita dakini

Locality	Inner terminal spinules	Outer bristles
Waikiki Marine Lab. (Mar. 28, 1942)	4	3
Locality as above (Apr. 24, 1942)	largest 3	3
	middle-sized 2	4
	smallest 1	2
Sta. 62–57, Bora Bora (9 mm.)	2	3
Howland I.	2	3
Society Is.	1	3
Sta. 62–57, Bora Bora (12 mm.)	0	3

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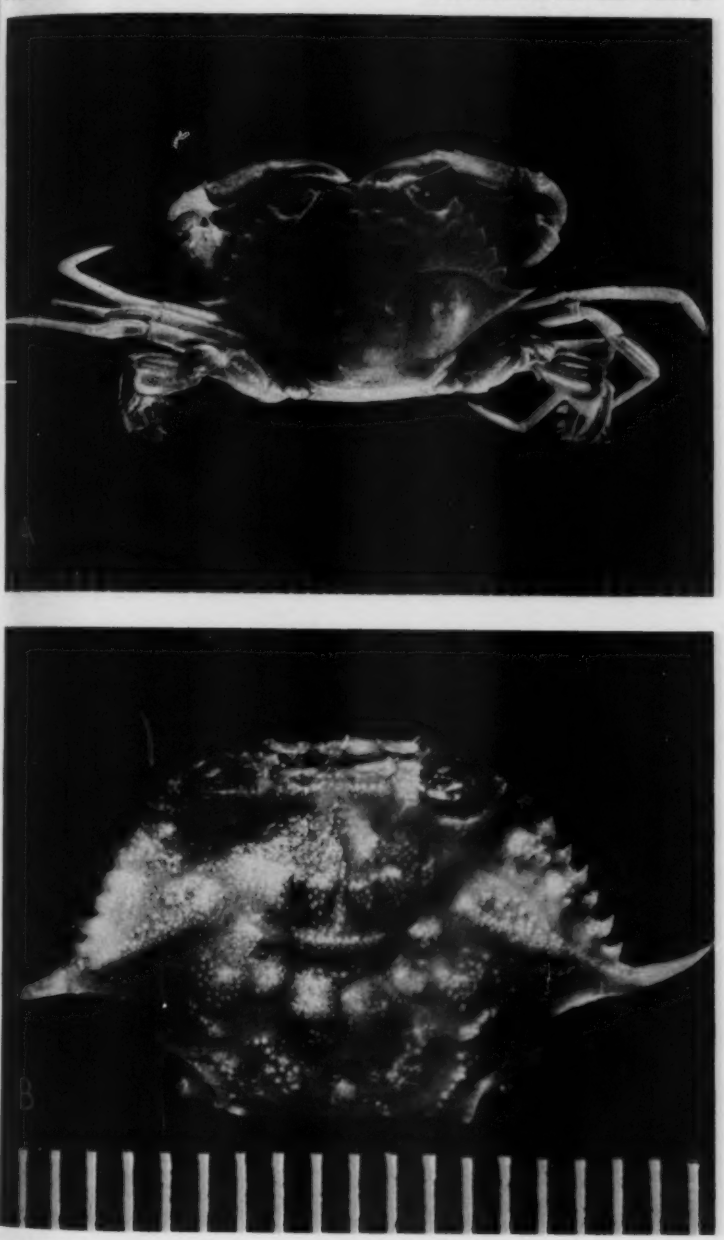
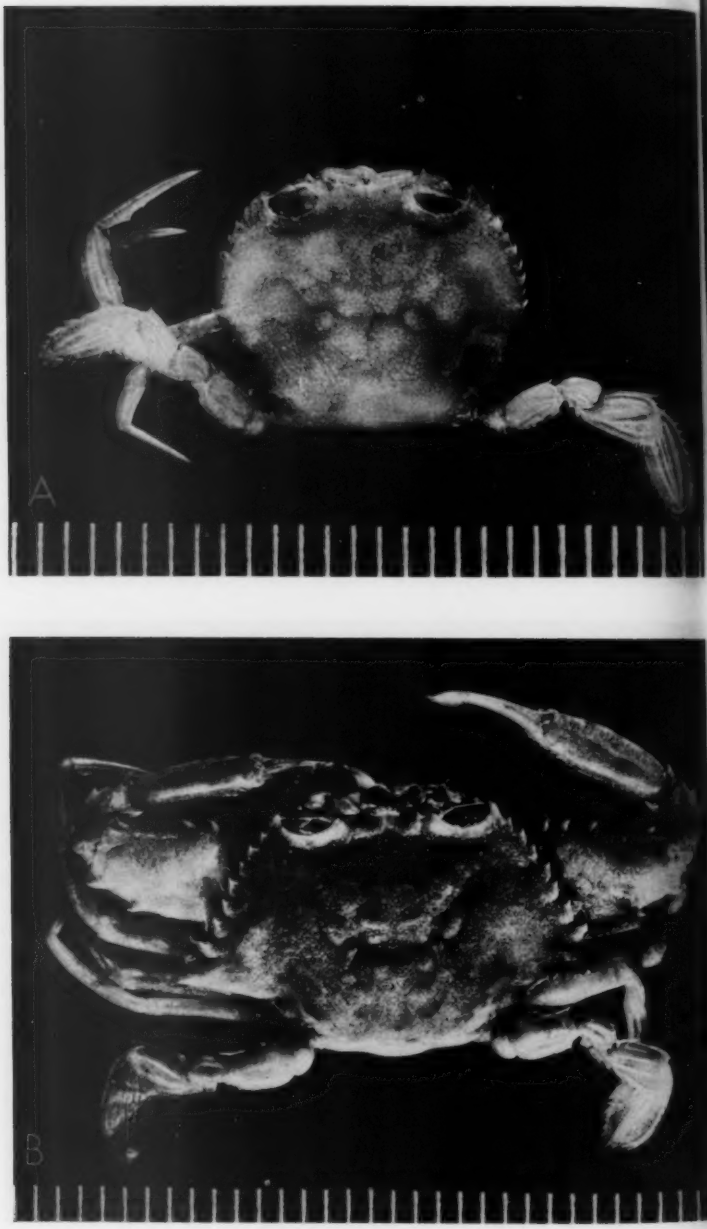
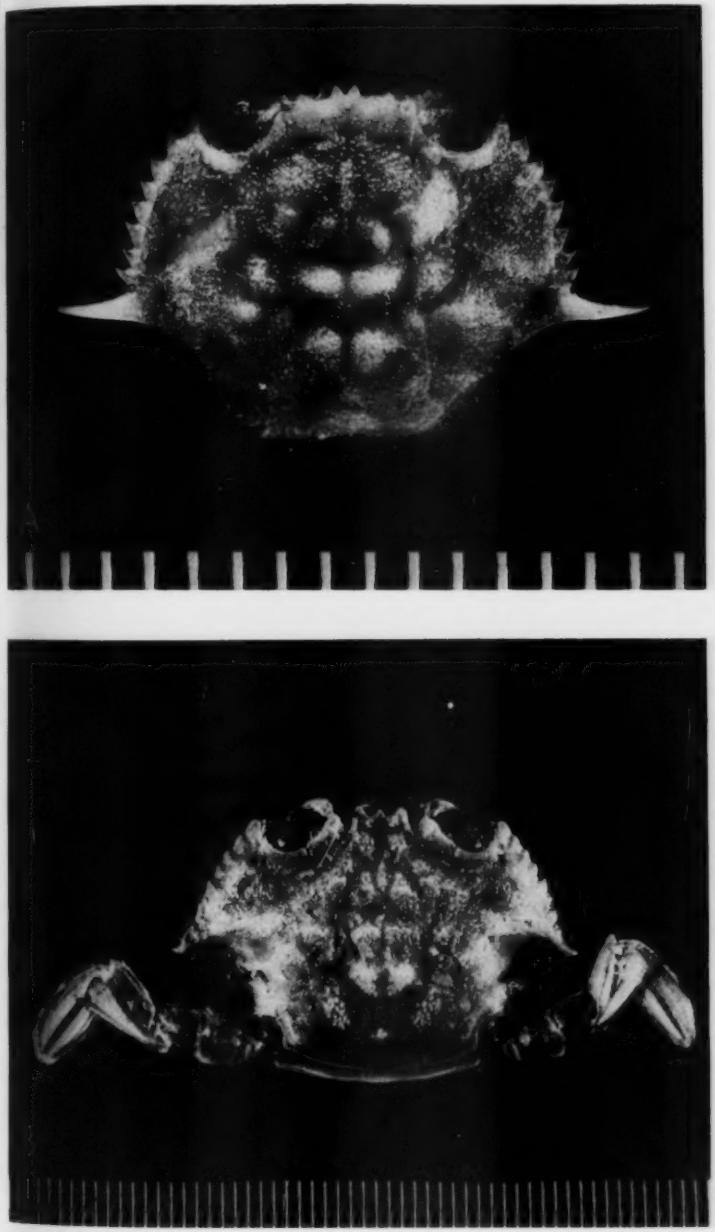
Plates



A, *Charybdis curtilobus*, new species, holotype. B, *Portunus acerbiterminalis*, new species, holotype. (Scale 1 mm.)

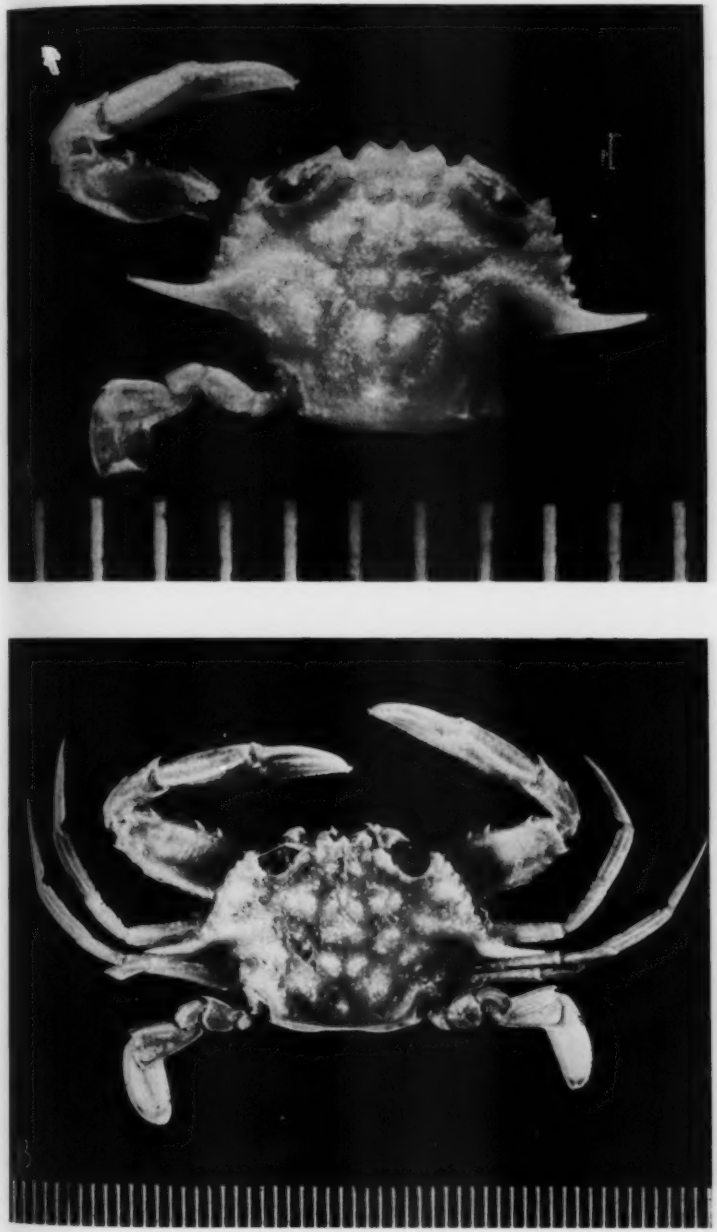


A, *Portunus dubius* (Laurie), male, Philippines, Sta. 5432, *Albatross*. B, *P. euglyphus* (Laurie), male, Philippines, Guijulugan, *Albatross*. (Scale 1 mm.)



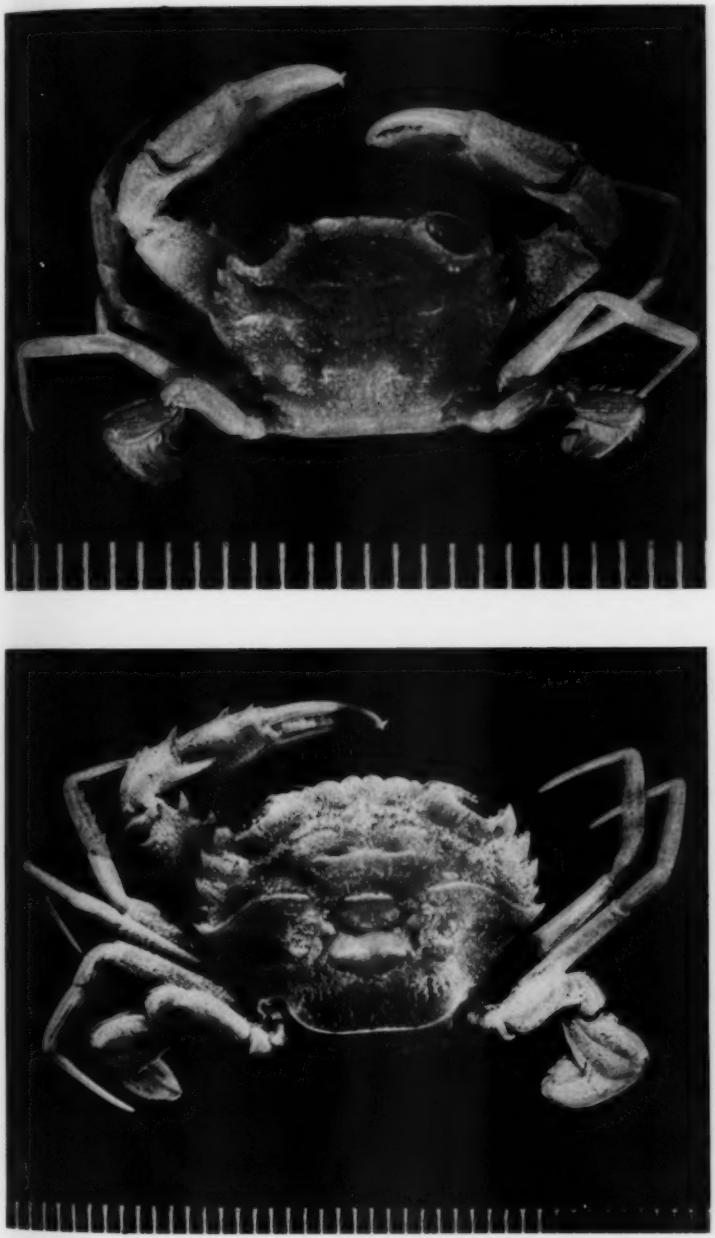
A, *Portunus* cf. *rubromarginatus*, juv., Japan, Sta. 5081, *Albatross*. B, *P. rugosus* (A. Milne Edwards), form I, ovig. female, Philippines, Sta. 5157, *Albatross*. (Scale 1 mm.)

Portunus rugosus (A. Milne Edwards), form I: A, female, Philippines, Sta. 5182, *Albatross*; B, male, Philippines, Sta. 5159, *Albatross*. (Scale 1 mm.)

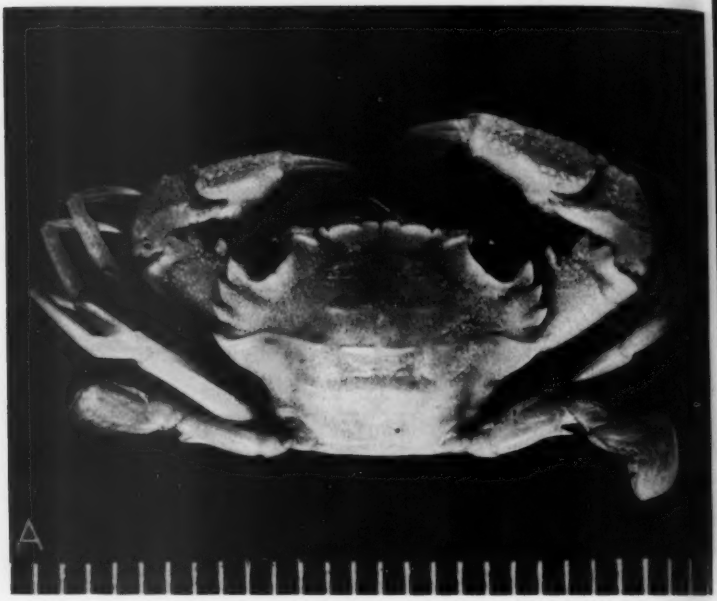


Portunus rugosus (A. Milne Edwards): A, form I, juv., Philippines, Sta. 5158, *Albatross;* B, form II, male, Philippines, Sta. 5159, *Albatross.* (Scale 1 mm.)

A, *Portunus spiniferus*, new species, holotype. B, *P. tuberculosus* (A. Milne Edwards), Philippines, Sta. 5159, *Albatross*. (Scale 1 mm.)



A, *Thalamita imparimana* Alcock, Philippines, Sta. 5131, *Albatross*. B, *T. multispinosa*, new species, holotype. (Scale 1 mm.)



A, *Thalamita philippinensis*, new species, holotype. B, *T. pseudopoissoni*, new species, holotype. (Scale 1 mm.)

Thalamita spinimera, new species, holotype. (Scale 1 mm.)